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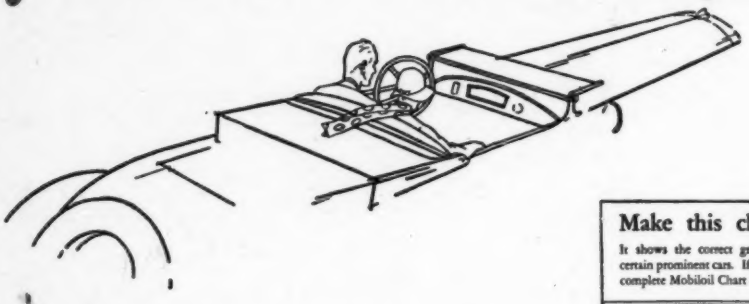
JUN 7 1929

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

SEE PAGE 108

We offer you 30,000 of the finest miles you've ever driven!



And we make this startling statement! Give your engine proper care, use the New Mobiloil and the first-year feel will stay in your good engine for at least 30,000 miles. In tests, the New Mobiloil has frequently preserved this first-year feel for more than *twice* this distance.

Make this chart your guide

It shows the correct grade of Gargoyle Mobiloil for certain prominent cars. If your car is not listed below, see complete Mobiloil Chart at your Mobiloil dealer's.

NAMES OF PASSENGER CARS	1929 Engine		1928 Engine		1927 Engine		1926 Engine	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Auburn, 6-66	...	...	...	...	...	...	A	A
" 8-cyl.	BB	Arc.	BB	Arc	BB	Arc.	A	Arc.
" other models	A	Arc.	A	Arc	A	Arc.	A	A
Buick	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
Cadillac	BB	Arc.	BB	Arc.	BB	Arc.	BB	Arc.
Chandler Special Six	...	...	A	Arc.	A	A	...	...
" other models	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Chevrolet	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Chrysler, 4-cyl.	...	...	A	Arc.	A	Arc.	A	Arc.
" Imperial	BB	Arc.	BB	Arc.	A	A	A	A
" other models	A	Arc.	A	Arc.	A	A	A	A
De Soto	A	Arc.	...	...	...	...	...	...
Dodge Brothers	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Durant	A	Arc.	A	Arc.	...	...	A	Arc.
Erskine	A	Arc.	A	Arc.	A	Arc.	...	...
Essex	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Ford, Model A	A	Arc.	A	Arc.	...	...	...	...
" Model T	...	...	...	...	E	E	E	E
Franklin	BB	Arc.	BB	Arc.	BB	BB	BB	BB
Gardner, 8-cyl.	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
" other models	...	...	...	...	...	...	A	A
Graham-Paige	BB	Arc.	BB	Arc.	...	...	...	...
Hudson	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Hupmobile	BB	Arc.	BB	Arc.	A	Arc.	A	Arc.
La Salle	BB	Arc.	BB	Arc.	BB	Arc.	...	...
Marmon, 8-cyl.	A	Arc.	A	Arc.	A	Arc.	...	...
" other models	...	...	BB	A	A	A	A	A
Moon	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Nash, Adv. & Sp. 6	BB	Arc.	BB	Arc.	BB	Arc.	A	Arc.
" other models	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Oakland	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Packard	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Peerless, 72, 90, 91	BB	A	BB	A	BB	A	BB	A
" other models	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Plymouth	A	Arc.	...	...	...	...	...	...
Pontiac	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Stearns Knight, 6-80	BB	Arc.	BB	Arc.	...	...	...	...
" other models	BB	A	BB	A	BB	A	BB	A
Studebaker	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Velie, 8-cyl.	BB	Arc.	BB	Arc.	...	...	...	...
" 6-cyl.	A	Arc.	A	Arc.	A	Arc.	A	Arc.

the New

GARGOYLE

Mobiloil

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Heats Home for 25¢ a Week!

"I can run my Bulldog furnace steady for fourteen days in normal weather conditions on the actual cost of fifty cents." So writes F. R. Redetzke, of Cleveland, North Dakota, and he adds: "Hard to believe is it? That's what some of my neighbors thought until I showed them! We have an unlimited amount of grain screenings in this country. That's the fuel I am using."

That's what the Bulldog does with about the lowest grade fuel you can think of! Here's what it does with coal:

After 6 Years—"Heats as Good as Ever"

"Our furnace has been in use 6 years and heats as good as ever."
—Arthur Cloepfil, R. F. D. No. 1, Rockport, Mo.

"Does the Work of 3 Stoves"

"This is my third winter with the Bulldog. It does the work of 3 coal stoves that I used, which only warmed up part of the house and not very well at that. My Bulldog not only does that, but 3 rooms upstairs, with great satisfaction. My house is located in a very cold place, with no protection at all. It is the easiest furnace to handle I have yet seen." E. C. Diplock, 105 Elm St., Camden, Me.

Cuts Coal Bill in Half

"I had a hot air furnace in our 7-room house before I got the Bulldog and our house was always cold. With the Bulldog it only takes *half as much* coal and we had weather below zero, and the house was nice and warm in the morning when we got up. We never have the draft on more than half an hour at a time, and it has the place red hot. It keeps the fire all day in mild weather."
—Jess T. Conrad, 1211 W. Arch St., Shamokin, Pa.

No Money Down!

Small Monthly Payments—Installed Almost as Easily as a Cook Stove!

The Bulldog is sent to you for *free inspection.* Then, if satisfied, you make only small monthly payments at our remarkably low price. Write today! *Don't* miss this chance to cut down your fuel bills! *Install a Bulldog Furnace.* It comes to you completely erected — goes through any door — fits any height of basement — and you install it yourself in less than two hours! In fact, you can install the Bulldog just about as easily as you would a kitchen stove. *Don't* put up with the old fashioned stove heat or some outworn furnace — when you can so easily get the greatest advance in scientific heating at an astonishingly low price. The Bulldog burns almost *any* kind of fuel, from hard coal to cheap screenings. Keeps wood fire over night. **Factory connections in both east and west. We ship from the nearest point.**

Send for Free Book

Learn how to have all the heat you want—where you want it—and save money! Remember the Bulldog is *different* — and *better!* Complete combustion of gases save 25% of your fuel bill. Exclusive Gable-Top Radiator receives *all* the direct rays of the fire. Exclusive oblong fire-pot is not only ideal for coal, but enables you to keep a wood fire over night. Remember—the Bulldog is sent for *free inspection*—then small monthly payments at an amazingly low price! Send for Free Book TODAY!

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Without obligating me, please send me your free catalog and special offer on the Bulldog Furnace.

Have you a basement? *Yes* ☐ *No* ☐

Name .....

Street Address .....

Town .....

County ..... *State* .....

PILOT JONES – PLANE A B C EASTBOUND WHAT ARE WEATHER CONDITIONS AHEAD?
3976
ALL STATIONS BETWEEN HERE AND CHEYENNE REPORT CLEAR WEATHER, CHEYENNE REPORTS RAIN STORM APPROACHING FROM NORTHEAST.
WEATHER MAP

How the Air-Mail Radiophone Works; the Pilot Is in Constant Communication with Ground Stations at 200-Mile Intervals and Knows the Weather Conditions Ahead at All Times

Popular Mechanics Magazine

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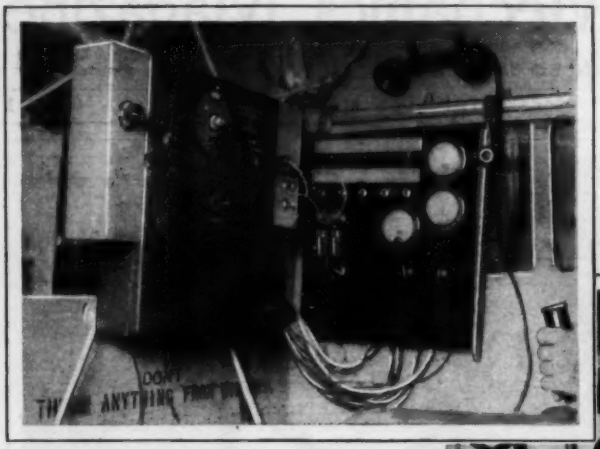
WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 52 JULY, 1929 No. 1

E. T. Allen, Veteran Mail Pilot, Talking over the Two-Way Radiophone That Links Pilots of Boeing Air-Mail Planes with the Ground Superintendents along Their Route

LAYING the world's longest day-and-night air line out in signal control blocks like a railroad will be started soon, when the Boeing company completes twelve radiophone stations between Chicago and San Francisco. With the beginning of regular passenger service in eighteen-passenger air liners this summer, each passenger and mail plane will be in constant communication with the ground over the entire route.

From the moment he takes off until he lands, the pilot will get reports at twenty-minute intervals on weather conditions ahead, and will be able at any time, by throwing a switch from receiving to sending, to communicate with the nearest ground station.



The Radio Receiver and Transmitter in a Boeing Ship, and, Right, Bell Telephone's Flying Radio Laboratory

Months of experimenting, both with radio apparatus and ships, to eliminate static and other interference, has culminated in the development of a combination transmitter and receiver which weighs only 100 pounds. For transmission, a 1,000-volt generator winding has been superimposed over the regular winding on the plane's engine-driven generator, which supplies the current for the lighting and starting systems.

The radio apparatus itself requires no tuning or other attention from the pilot, being operated from a remote-control switch on the instrument board. Tiny earphones, imbedded in soft rubber plugs molded from a cast of each pilot's ears, and a transmitter, swung like a telephone girl's phone in front of his lips, provide channels of communication without interfering with the operation of the ship, or distracting his attention from that duty.

Before the radio tests were successfully concluded the experimental plane had to be almost entirely rebuilt. The shielding of the motor to eliminate interference from the high-tension ignition current was only a part of the problem. Every loose part that rubbed, and every moving part of controls, produced static which, while not interfering with code transmission and reception, made talking virtually impossible.

With the radio system in operation, the movements of the fleet of passenger and mail planes will be as completely controlled as those of railroad trains traversing electric-block-protected rails. The twelve ground stations, spaced at about 200-mile intervals, will enable a plane always to be in touch with at least one, for the equipment in the ships has a 200-mile range. With that range, ships also can talk with each other, while to reach a brother pilot at a more distant point, the flyer in one ship can have his message relayed through the ground chain.

The twelve stations, some of which have already been completed, are to be at Oakland and Sacramento, Calif., Reno and Elko, Nev., Salt Lake City, Utah, Rock Springs and Cheyenne, Wyo., North Platte and Omaha, Nebr., Des Moines and Iowa City, Iowa, and at the Chicago municipal airport.

Describing the operation of the system, E. T. Allen, one of the pilots who aided in the experimental work, describes an

experience, when, flying above a deep fog bank, he heard the voice of the superintendent at the next stop, reporting a 1,100-foot ceiling over the airport, with five-mile visibility and no indication of change in the next thirty minutes. The pilot reported back that he was thirty miles away, making 115 miles an hour. With a directional loop, the ground operator located the position of the plane and reported back that it was five miles south of its course, gave the course correction to get back in line to the airport, and announced a yellow signal rocket would be sent up when the plane arrived within three miles of the airport.

Allen reported back to the ground that the top of the cloud bank that he was flying over had an altitude of 8,800 feet, which would give a cloud thickness of 1,500 feet resting on the mountains above which he was flying. The ground station replied that at Summit, a station in the mountain pass, the fog began to rise as the ground dropped away to the valley.

Back from the plane came the message that it would arrive at 9:13 p. m. over the airport, and that the signal rocket should be fired vertically at 9:11 to mark the field. The switch was thrown to receive, and the ground reported that the second section of the eastbound mail was seventy minutes behind Allen's plane, but that the westbound first section was due about the same time as Allen. Orders, however, had been phoned to the westbound pilot to delay his arrival until after Allen had landed

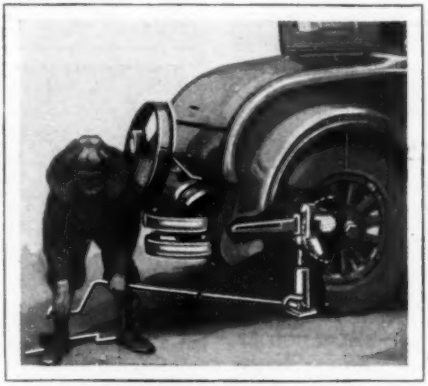
So That Jurors May Hear the Witnesses, Loud Speaker and Microphone Are Installed in Cincinnati Court Room

LOUD SPEAKER IN COURT ROOM AIDS IN JURY TRIALS

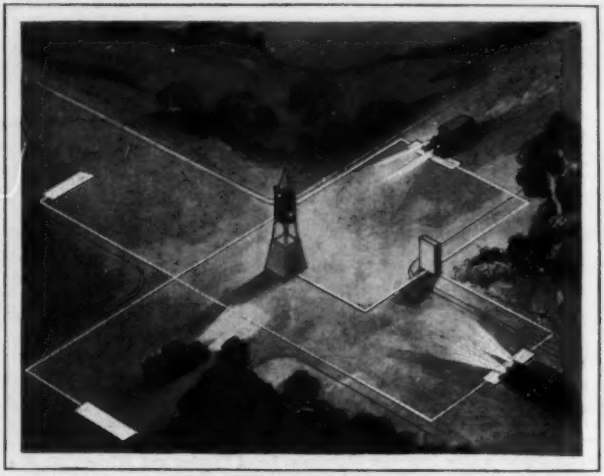
So that jurors may hear the testimony of witnesses more plainly, a radio microphone and loud speaker have been installed in a Cincinnati court room. The speaker is attached to a wall and directed toward the jury box, while the microphone faces the witness stand.

AXLE FRAME FOR AUTO JACK PREVENTS CAR SLIPPING

Adjusting the jack under the car is simplified with a frame that holds the jack perpendicular under the axle when in place, even when the car is on a slope or if the brakes are not set. It saves getting down on the hands and knees, insures a steady position for the car when the wheel is off, and eliminates most of the troubles involved in using the jack in the ordinary way. It is not conspicuous when properly installed.



Axle Frame, Seen Just above the Jack, Keeps the Car from Slipping Even on a Slope



Drawing to Show How the Switches in the Pavements, Operated by Passing Cars, Set Traffic Lights at Center

TRAFFIC SWITCH IN STREET SERVES AS POLICEMAN

Traffic controls itself with the aid of electric switches placed at the approaches to street intersections. They are on the level of the pavement and scarcely visible, but the passage of vehicles over them causes an electric contact which operates the control box. This is simply a light post, placed in the center of the intersection to act as a traffic policeman. For instance, a car approaches the crossing on the main street. As it passes over the switch, it lights a green light facing the approach, while a red one stops traffic on the crossing street. The green remains on for a fixed interval, then automatically shifts to red, while the cross-street light changes to green. Tests with the installation have proved successful, according to reports.

DRESSING STOPS RUGS SLIPPING ON POLISHED FLOORS

To keep rugs from slipping, a preparation is applied to the reverse side with an ordinary paint brush. It is said not to harm any rug, will not mar the floor and will last a long time. The substance helps keep out moths, and when rugs are firmly anchored with it, they are more easily swept with the vacuum cleaner.

LANDSCAPED GOLF COURSE INDOORS GIVES THRILLS

Golf among the skyscrapers is enjoyed during luncheon and other hours by players in an eastern city, where an eighteen-hole course with real water hazards and other features of the regulation links has been installed in an office building. Real balls and real clubs are used, and the course is not merely a make-believe field, but one requiring exceptional skill to make the round in a par of forty-two strokes. Six tons of rock and quantities of sand, gravel and clay were employed in the construction of the course, which cost approximately $10,000. It is patronized by more than 1,000 persons a week. A feature of the links is the outer covering of cottonseed hulls. The course affords mashie niblick shots on six holes, four water jumps, one stone-wall hop, one over bushes to a rising green, and a right-elbow chip shot over a sand trap and bushes.

ELECTRIC PEN WRITES IN GOLD ON WOOD OR LEATHER

Lettering in gold and silver leaf or colors upon leather, glass, metal, and

Using the Electric Pen for Lettering on Leather Case; It Operates on House Current

Views of the Boat in Use, and with the Flap Raised, to Show How It Keeps Water Out

FLAP ON MOTORBOAT GUARDS ENGINE FROM SPRAY

To guard the engine of an outboard motorboat from the surf and spray while the craft is being launched, a water-tight flap has been devised in England. It does not interfere with the operation of the boat and can be raised for inspection of the engine. It is also useful when the boat is running, as it will keep the water from splashing the motor.

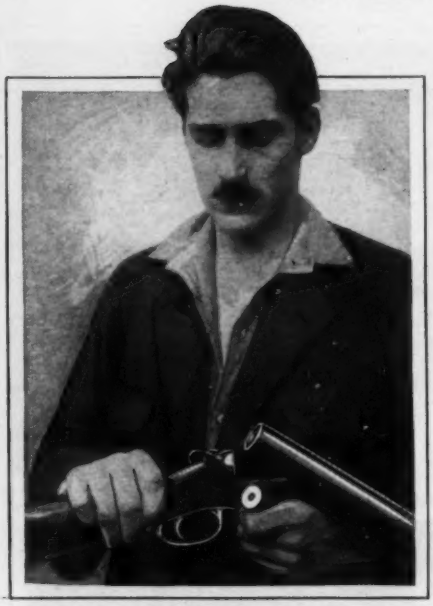
Courtesy Elto, London

other materials, is simplified by an electric pen, supplied with current from the house-lighting circuit. The inscription is traced through a special transfer paper, laid upon the object, the heat of the pen point melting the metal foil. The heat can be controlled and the pen may be employed also for the purpose of burning plush, leather and wood, or in making inscriptions upon photographic negatives.

¶Write our Bureau of Information, if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

AUTO PARKING BRAKE IS SET BY DRIVER LEAVING SEAT

When the driver removes his weight from the seat, a hydraulic parking brake, developed in France, is automatically set. Coil springs force a yoke upward against a collar on the piston rod of the device, thereby applying the brakes. As long as the driver is in his seat, his weight prevents the action. The same principle is planned for automatically locking a car through the ignition or transmission.



Gun That Is Fired Electrically in One-Thousandth of a Second

GUN IS FIRED BY ELECTRICITY TO GAIN SPEED

Faster firing is claimed for a gun devised by an Austrian inventor. It is fired by electricity in about one-thousandth of a second, whereas the time for the usual weapon of this sort is approximately one-tenth of a second. The gun was shown to Austrian military authorities recently.

OLD MILL PONDS TO YIELD MILLIONS OF DOLLARS

Due to improved methods in metallurgy, old mine dumps and ponds of mill tailings throughout the west are now yielding millions of dollars in gold and silver. One instance of exceptional success along this line is found at Goldfield, where the tailings pond below a mill is being retreated. Gold ore worth approximately $55,000,000 was run through the mill in the boom days of Goldfield, and the tailings average a little over a dollar a ton in recoverable gold. In 1928, over 245,000 tons were treated, and more than $245,000 recovered by the operators. Cost of operation is very low, and the plant yields a handsome profit. The material in the pond is ample to last five or six years more. An unusual feature in the operation of this plant is the fact that a considerable tonnage of copper is produced, although the original ore failed to show any copper in the assays, and none was recovered in the old mill.

SECOND ANCIENT BURIED CITY FOUND IN NEVADA

Working under the direction of Mark Raymond Harrinton, archæologists have found a second "lost city" in southern Nevada, about four miles from the site of one discovered two years ago, according to an announcement by Dr. James B. Scherer, director of the southwest museum. Scholars estimate that 1,500 years have passed since the city was abandoned. Relics, including a few implements, jewels and a number of skeletons have been uncovered. Evidently the city had a population of nearly 10,000 persons. Scientists are at a loss to account for the apparently sudden evacuation of this and the other city discovered.

DOUBLE-DECK BRIDGE REDUCES DELAYS IN TRAFFIC

Separately operated decks in a railroad bridge at Portland, Oreg., reduce traffic delays as compared with the usual type of structure. When a ship with a short mast must pass under, it is necessary to open the lower deck only, leaving the upper one,

Twin-Deck Bridge at Portland, Oreg., So Arranged That Lower Level Can Be Raised Independently

which is used by street cars, automobiles and pedestrians, to remain in service. The lower deck is devoted to trains.

"MERRY-GO-ROUND" TO TEACH STUDENT FLYERS

Model of the Proposed Merry-Go-Round for Instructing Student Aviators; Planes with Regulation Controls Are to Be Attached to the Whirling Arms and Guided as They Spin

To help train aviators, a Chicago man proposes a revolving apparatus somewhat like a merry-go-round, from the arms of which would be suspended dummy planes with regulation controls. Students sitting in these anchored ships would have an opportunity to duplicate many of the operations that they would perform in real flying, but in greater safety, as the plane cannot crash. Banks, climbs and descents can be made, the inventor claims.

RADIO-CONTROLLED CAR TO TRY FOR AUTO SPEED RECORD

A disk, worked by wireless, on which a red arm like a compass needle indicates the smallest deviation from the straight course, is to be used to steer a new motor car, with a speed of 400 miles an hour, which will be used on Daytona Beach, in 1931. The designer, an English engineer, C. Amhurst Williams, is using engines fitted with a highly developed system of supercharging, and the car will run on wheels of a novel type. Steam, with an auxiliary chemical process, will come into play automatically and cool the engines, should they attain abnormal heat. All of the eight wheels will be directly driven. The new car, weighing four and a half tons, is stated to be able to accelerate to 350 miles an hour in two miles.

FLOORING "FLOATED" ON CLIPS TO DEADEN SOUND

Specially designed clips, which isolate the flooring from its base, are used in connection with insulating material to reduce the noise in apartment and other buildings. The clip proper is a steel plate, and is so adjusted that the sleepers under the floor "float" without metallic contact between the subfloor and the finished floor.

From Barnstorming

Loading Passengers into One of the Single-Engined All-Metal Planes Used by Northwest Airways on Its "Local" Run between Chicago and the Twin Cities of Minneapolis and St. Paul

AN AGED air-mail pilot—old, that is, as pilots' ages go—climbed aboard a rebuilt Laird ship in which he had been flying the air mail the other day and went up and did an outside loop, the first time in all history it had ever been done by a commercial pilot in a commercial ship not specially built and reinforced for stunting.

That made Charles "Speed" Holman the fourth man in all the world to loop an airplane with his head on the outside of the circle, the other American to do it, Lieut. Jimmie Doolittle, in a special Curtiss military plane, having been first.

"Speed" Holman, barnstormer, wing walker, parachute jumper, holder of two transcontinental race records, stunt man, outside looper, holder of the world's consecutive-loop record, mail pilot, holder of the American commercial air-line speed record, and, ranking pilot of one of the most successful air-mail lines in America, if not the world, learned several years ago that he would never be able to fly. An army doctor broke the news when he turned "Speed" down for the service schools, declaring he was too deaf ever to become an aviator.

Too deaf to fly for Uncle Sam, he got Eddie Ballough, the famous veteran of commercial flying and speed-ship building, to teach him to handle a ship. Too deaf to join the army, according to the doctors, he holds, among his own other records, the world's mark for having performed 1,433 loops without stopping, or five loops a minute for something more than four hours. He was awarded the commercial speed trophy for last year for piloting a mail plane 350 miles between terminals in one hour and forty-eight minutes, or an average speed of 185 miles an hour.

The story of "Speed" Holman introduces one of the greatest air lines—the Northwest Airways, of St. Paul and Minneapolis, flying the mail and passengers on three routes between the twin cities and Chicago, Milwaukee and intermediate points.

It is unusual because it was organized

to Air Liners

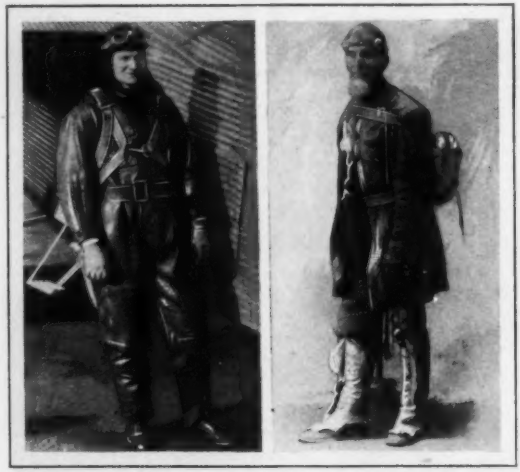
Freddie Whittmore, of Northwest Airways, at the Controls of a Hamilton Plane; the Control Wheel and Stick Are Seen through the Round Window, Which Gives the Pilot a View of the Ground

by an ex-army colonel who knew nothing about flying and had no desire to become the principal stockholder, vice president and general manager of an air line, all of which happened to him; and it is remarkable because it employs only ex-barnstormers, wing walkers and parachute jumpers for pilots, and because, in two and a half years of flying, those nine barnstorming graduates have never injured a passenger or themselves, never lost a piece of mail and never cracked up a ship.

That accident-free record is unique and Col. L. H. Brittin, the founder and manager of the line, lays it to the barnstorming training of the nine pilots and the past experience of the mechanics on the ground—mechanics as unusual in their way as the pilots are in their training.

"We started with the idea," Colonel Brittin explains, "that the men who had barnstormed their own planes for years through winter and summer, in the northwest territory we planned to serve, were the best men to fly our ships in that same district. We had nothing against army-trained pilots—they are fine fellows and fine flyers—but we believed that the men who had learned to nurse Wright pushers through the air, patch up wartime Jennies with hay wire and keep them going, and care for their own property to keep it flying, had peculiar gifts that we might utilize.

"'Speed' Holman was our first pilot, and he picked the rest, men he had known intimately for years. 'Speed' originally was a parachute jumper in his barnstorming days around the county fairs in Minnesota, the Dakotas and Montana. All of our flyers have been in the game ten to fourteen years. While none of them were army-trained, several served as instructors at army flying fields during the war, and turned out scores of the boys who did go overseas.



It Took Alexis Clermont, Right, a Month to Carry the Mail, in 1832, over the Same Route Chad Smith, Left, Covers in Less Than Two Hours

"Our accident-proof record, and the fact that our boys hold more of the commercial flying records than any other one organization in the country, gives the best proof that our policy has been a success. Holman is not our only record holder. There's Chad Smith, who won the record last year for more hours in the air than any other air-mail pilot, with a total of 1,173 hours and fifteen minutes of flying time. When you remember that 300 hours a year is considered quite a respectable lot of flying, you can appreciate the amount of work Smith did.

"Then there is Homer Cole, who has the single-motored speed record for last year, won by covering the mail route between the Twin Cities and Chicago at 168 miles an hour, not far below Holman's tri-motored mark of 185 miles. Walter Bullock, our oldest pilot, has been flying for fifteen years, starting on an old Wright pusher, in which he barnstormed the Minnesota towns and made a living taking farmers and villagers for a ride.

"In picking our mechanics, we followed the same system employed in choosing pilots. They are all old-timers, both in experience and in years. Andy Hufford, the chief motor mechanic, came to us from the test laboratories of the Wright Aeronautical corporation. He was in charge of Sir Hubert Wilkins' motors on his north polar flights. Jim Lamont, our chief ship mechanic, was the first ship rigger employed on the original government air-mail line and is probably the oldest and most experienced ship mechanic in service today. Ray Mahr, another of the motor experts, also came from the Wright company's testing laboratory."

What such a force of men can do was demonstrated last December when the Northwest Airways opened up its Fox River valley line, an air-mail route that starts at Milwaukee and takes in Fond du Lac, Oshkosh and other towns on its way to Green Bay, Wis. When the line started, the fields were buried deep in snow. The planes—Stinson cabin ships—were mounted on skis. To reach them on the snowbound fields outside the towns, mail men, also mounted on skis, brought the bags out on their backs.

When spring came and the snow melted off, trouble began. The flying fields, picked in winter and entirely undrained and unimproved, turned to seas of mud. The Stinsons, with a slow landing speed, could be pancaked into the fields, but no ship could fly out of the mud. The pilots, however, solved the difficulty by calling for horses to tow the planes out onto the hard roads. Before they took off, a motorcycle man would be sent a half mile up the road to stop all traffic, and the planes would follow behind, mounting into the air with wing tips almost brushing the telephone wires as they flashed by.

Under such conditions the nine pilots keep three routes going for a total of 1,700 miles of flying daily. The schedule calls for three to make a round trip every third day, with two days' rest between. With his two spare days between flights, and a love of flying undimmed after fifteen years in the air, Walter Bullock has established an industry of his own, building perfect scale models of the various ships used by the line. His tri-motored models, perfect in every detail, take his spare time for a month to build, and have been rated as the finest all-metal Ford models ever built.

Colonel Brittin's introduction to flying

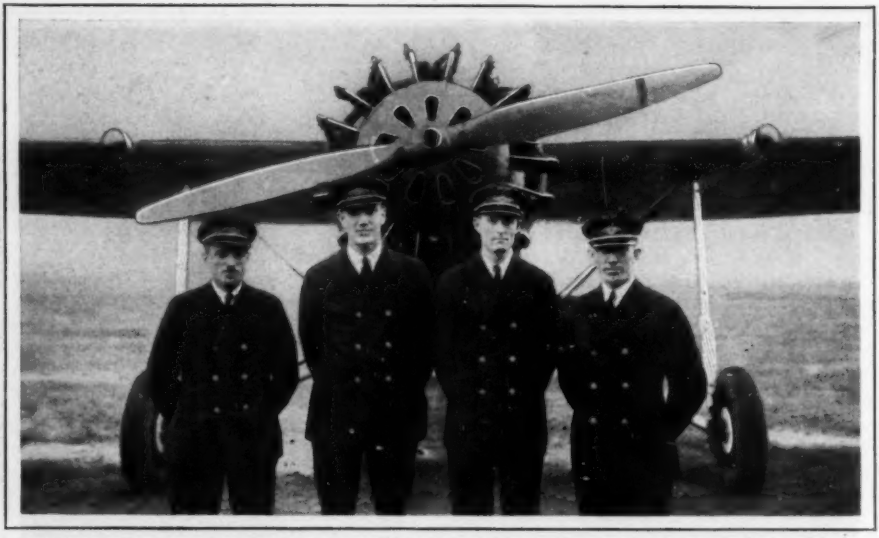
The Through Express, at the End of a Non-Stop Journey from Chicago, Banking around the Field before Settling to Land on the Airport Colonel Brittin Launched at St. Paul

was as unusual as the line he established. As head of the chamber of commerce in his home town of St. Paul, he had been instrumental in promoting a bond issue for an airport, in order to get an air-mail line into his city. Within a few months, the air-mail contractor announced he would abandon his contract, because the line was operating at a loss. After vainly trying to persuade every established airway operator in the middle west to take over the job, Colonel Brittin finally was forced to promote a line of his own, to avert criticism over the airport-bond issue. With two borrowed ships, and "Speed" Holman for pilot, he took over the job the day after the first contractor retired, and managed to keep the service going, paying most of the operating expenses out of his own pocket, while three Stinsons were being built.

One of the country's best-known flyers, formerly commander of the First Pursuit squadron, recently became operations head for a new combined air-mail and passenger line, and announced that he was able to find only seventeen pilots in the United States who measured up to his requirements, and who were not already permanently established with other lines. He needed some thirty men, so took on a number of "junior" pilots, to be trained by the expert men. And everyone of his junior pilots already had a long total of hours in the air.

On the Northwest Airways, the problem of second, or emergency, pilots for the big three-motored ships is being solved by training the stewards to handle them.

"We first thought of the junior-pilot idea," Colonel Brittin explains, "but abandoned it because the chance of their getting any actual flying experience was very slim, as we expect the regular pilots to do all the flying. Then we considered sending a mechanic, with flying training, on each ship, but the supply of mechanics capable of 'shooting trouble' in $9,000 engines is too limited to waste their time training for an emergency that may



All the Pilots Wear Uniforms; Here, from Left to Right, Are Homer Cole, John Malone, Walter Bullock and Fred Whittmore; Bullock Is a Famous Builder of Scale Airplane Models

never occur in a lifetime. We finally settled on the plan of picking flying-school graduates for the uniformed steward service—one steward flies with each of the big passenger ships—and putting them through a special course in handling the tri-motored planes.

"If the unexpected should happen and the regular pilot should become ill—something that is almost impossible in view of the constant check on their physical condition—the steward can take over the controls and fly the ship to the nearest field."

PYRAMID RISES FROM PAGE TO ADVERTISE PRODUCT

A novelty in advertising was introduced in a folding paper pyramid that rises from the page of a magazine. The two vertical bases of the device are attached to opposite pages and the two other bases are left free, with a crease at right angles from the base to the apex.

Recent Novelty in Advertising; a Colored Pyramid Unfolds from the Pages as Magazine Is Turned

As the reader turns the page, the paper pyramid unfolds and rises in the center of the magazine. It collapses when the next page is turned, and lies so flat that its presence is not noticeable before or after the place where it is attached is reached. Bright colors help attract the attention of the reader to this unusual device.

BADGERS USED TO DIG HOLES FOR FOX BURROWS

Badgers are employed on a fox farm near Elko, Nev., to dig burrows for the foxes. The superintendent formerly provided man-made tunnels, but the foxes did not accept them. The badger proved a much more successful digger. One was placed in a pen at night and by morning would have a suitable hole for the foxes. The badger was then removed to another task and apparently enjoyed his labors.

SCALE WEIGHS BY COUNTING TO SAVE FIGURING

When is a scale not a scale may sound like a foolish question, but when it can be answered sensibly by saying, "when it is a counting device," it doesn't seem quite so absurd. That type of scale has been introduced for offices, warehouses, shipping and stock rooms, to save time and trouble, and to give increased efficiency. It has a capacity up to forty pounds. The chart has only the zero mark with the words "under" and "over" on either side of the sign. When the indicator splits zero, the desired result has been obtained. There are three pans, the weighing scoop on the platform and the two balancing pans hung from the auxiliary lever. The procedure is simple. The parts to be counted are placed in the heavy scoop on the platform. It makes no difference what they are, nuts, screws, bolts, sheets of paper or other things. Parts are taken from the scoop and placed in the right-hand pan. When the indicator approaches zero and is on the "under" side, you have the count in hundreds. To get the count in tens, take more parts from the scoop, but never more than nine, putting them in the left-hand or the nine-to-one-ratio pan. If the pointer still does not split zero, count parts into the hand until it does.

Balances That Count Various Objects According to Their Weight; This Is Accomplished by a Ratio System

For example, four parts in the right-hand balance, seven in the left-hand pan and three parts in the hand would mean that you had 473 parts in all.

The average temperature of the earth is about fifty degrees Fahrenheit.

Built-In Loud Speaker in a Chicago Hotel, with Dials to Control the Volume and Choice of Four Stations

THOUSAND SPEAKERS IN HOTEL GIVE FOUR PROGRAMS

Installing a thousand built-in loud speakers, with control dials whereby each can be instantly tuned in on any one of four programs picked up by master receivers, is a task being carried out in the Allerton House, a large club hotel in Chicago. As all wiring is concealed, and as the building is built of concrete, steel and hollow tile, the installation presented unusual difficulties. The master receivers, located on the twenty-third floor, have four panels, each consisting of a monitor loud speaker, a twenty-four-hour clock control that can be set to turn the receiver on and off at any desired hours, a six-tube speaker and three amplifiers, with the necessary control jacks. Each amplifier is built to carry the load of as many as 200 loud speakers at a time, so that, with three amplifiers to each receiver, 600 rooms can be tuned in on a single program without loss of volume. The loud speakers in each room are mounted in flush wall plates, the speaker fitting into a steel box in the wall. To prevent a speaker from disturbing the occupant of the adjoining room, they are fitted into closet walls, instead of the dividing walls between rooms, and the volume control is limited to a maximum that makes disturbance practically impossible.

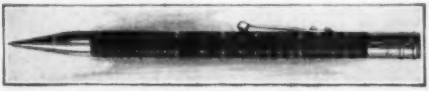
Schooner "A. Ernest Mills," Floating Again After Its Cargo of Salt Had Melted and Had Been Washed Away; the Vessel Was Sunk in a Collision

CARGO MELTS, FLOATING SHIP FOUR DAYS UNDER WATER

Loaded with a cargo of salt, the four-masted schooner "A. Ernest Mills," was rammed and sunk in a collision off the coast of North Carolina, not long ago. Four days later, the vessel bobbed up to the surface, the salt having melted, allowing the ship to float. Sailors attached cables to the hull, and the schooner was towed to dock for repairs.

PENCIL THAT SOLVES PROBLEMS SAVES EXTRA TOOLS

A pencil that tells how many dollars there are in a given number of francs, or vice versa, figures stock yields and performs many helpful tasks, has been placed



Sliding-Rule Pencil, Showing Markings and Numbers Used in Making Calculations

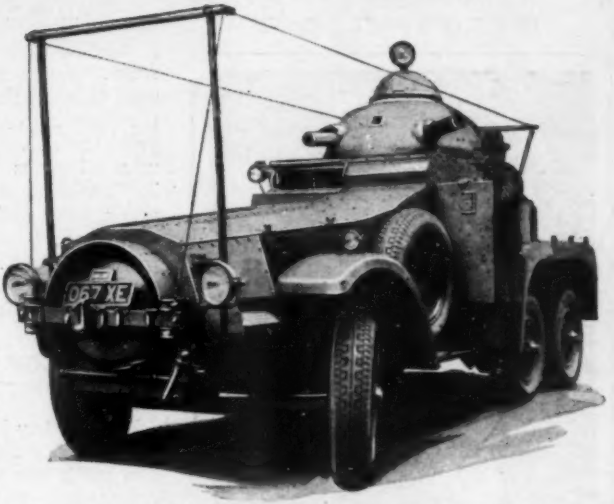
on the market. It operates on the slide-rule principle and can solve any mathematical problem involving multiplication or division. There are two sets of scales, one sliding on the other and, by moving them back and forth to the proper relationship, the answer to the problem is found. The pencil is easy to operate, is precisely marked on bakelite and has a refillable lead.

REFRIGERATOR AT FORTY BELOW TESTS RUBBER SAMPLES

Temperatures of forty to sixty degrees below zero are maintained in a refrigerator recently constructed for testing rubber under arctic conditions. This extreme cold is obtained simply by the utilization of the principle adapted for household refrigerators that require no gas or chemicals. Air is the only medium used, and the cold is produced simply by absorbing the heat from the air. No coils, valves or tubing are employed. A single-cylinder compressor is driven at slow speed and under low pressure by a quarter-horsepower motor. All moving parts are housed inside the compressor body, where they are automatically lubricated and are in turn surrounded by the air, which does the refrigeration at less than 100 pounds' pressure. Strips of brass of extreme thinness, wound on a bakelite core and tinned copper fins, that radiate the heat as it is absorbed from the air, are among the interesting details of the mechanism.

LESS COST SHOWS IMPROVEMENT OF ELECTRIC LIGHT

Incandescent electric-light bulbs, as well as other units of electrical equipment, have been much improved in recent years with consequent greater economy and efficiency. As the time for the celebration of the fiftieth anniversary of the incandescent light approaches, engineers have been comparing the performance of the early types with that of bulbs commonly used today. At seven cents per kilowatt-hour, it costs about $7.35, including the cost of the lamp, to light a room for 1,000 hours with a 100-watt Mazda lamp. To give as much light with the original incandescent bulb, would have cost $68.75.



Armored Car with Its Radio Masts and Antenna; the "Fort" Has Been Built for Service in India

TRAVELING FORT HAS RADIO FOR POLICE WORK

Fitted with receiving and transmitting radio sets, an armored car has been devised for police and military work in India. The wireless equipment has long range, and the car is built for service over rough roads. The radio can be operated while the "fort" is in motion.

NEW MAST FOR "OLD IRONSIDES" FILLS FOUR FLAT CARS

Occupying four flat cars, a huge timber of Oregon fir, 109 feet long, was shipped from the Pacific coast recently to Boston, to be made into a new mainmast for the "Constitution," the famous "Old Ironsides," now being restored in the Charleston navy yard. The big timber was placed on display in several cities.

Mighty Timber from the Pacific Coast, to Be Shaped into a New Mast for the Famous Relic "Old Ironsides"

AIR-SUCTION GRAIN THRESHER REQUIRES LESS POWER

Said to require but one-fifth the power needed for the ordinary machine and being only about one-tenth the size of the usual equipment, an improved threshing outfit, devised by a Nebraska inventor, operates with centrifugal force and an air-suction blast. It eliminates conveyors, cylinders, beaters and many other parts and can be operated in the field after the manner of a combination harvester. The inventor hopes to devise an arrangement for carrying bundles from the binder to the thresher.

VIOLIN FASHIONED OF MATCHES IN YEAR'S SPARE TIME

Musician with His Violin Made of 5,000 Match Sticks, Carefully Fitted Together and Glued

One of the most unusual violins in the world is that made from 5,000 matches by a Kentucky man. The sticks are carefully fitted together and are said to form a body that produces a melodious tone. A year was devoted to the task.

OVER HUNDRED MILES AN HOUR BOAT IS BUILT IN SECRET

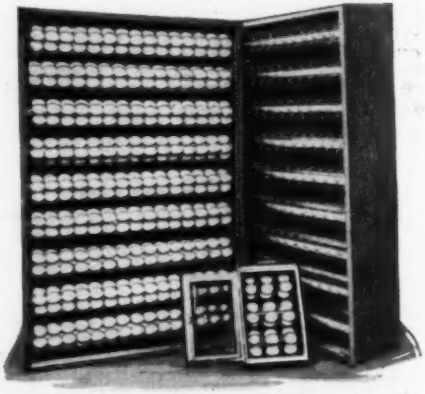
A new motorboat, of original design, has recently been constructed in secret at Cowes yards, Isle of Wight, Eng., which is said to have a speed of 140 miles an hour, and three times the horsepower of the boat "Miss England," with which Major Segrave failed to beat the record set by the world's champion motorboat racer, Gar Wood. The boat is owned by Miss M. B. Carstairs, who will run it in the Detroit river Harmsworth-cup race in September this year. The thirty-nine-foot hull is driven by three Schneider-air-cup Napier engines, with a maximum of 3,000 horsepower, but the novel feature of the boat is the propellers whose pitch is a revolutionary break-away from anything of the kind so far devised. The hull is shaped like a high-powered naval-gun shell, with a big bulge toward the razor-like bow and a tapering effect toward the stern. Not a nail of any sort has been used to build the hull, which looks almost too fragile to support the weight of the great engines. The outer skin is made of whole lengths of the finest mahogany, inside which are two inner shells of waterproofed silk and very thin ply mahogany, the whole being sewn together with a wiring of special alloy, making the hull very flexible, light and capable of maximum speed without breaking.

HANGAR OF BALED HAY HOLDS TWENTY AIRPLANES

Bales of hay have been piled up to form a hangar for airplanes in a western city. The walls are twelve feet high and the structure is 100 feet in diameter. The bales have been laid like brick with cement around each unit. Two coats of stucco are applied to the interior and exterior, and a metal roof has been constructed.

REVOLVING RACK FOR EGGS HELPS KEEP THEM FRESH

Eggs are held in wire brackets on revolving rods that can be turned around from time to time with handles so that the eggs will keep fresh longer. They are also easier to remove. The wire clips hold them securely and the arrangement simplifies the task of counting the supply.



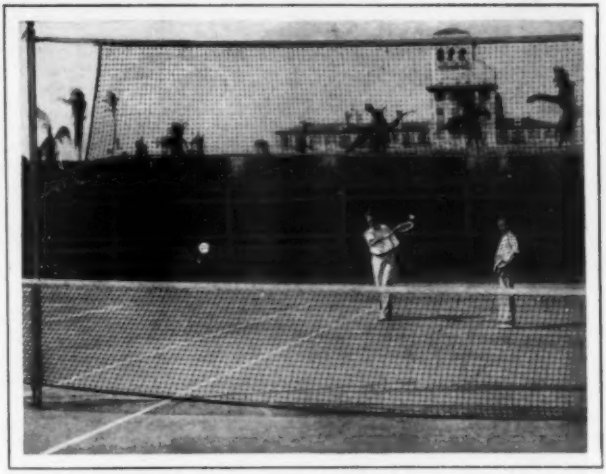
Eggs Keep Fresh Longer in This Case with Wire Bracket Holders That Can Be Revolved

LATEST "MIKE" TO IMPROVE RADIO

Experiments with a new microphone, without diaphragm and expected to reduce sound distortion and other troubles in broadcasting, were described to the National Academy of Sciences recently by Prof. Arthur L. Foley, of the University of Indiana. His invention is not yet ready for use in the studios, he said, but is being improved to the point where production is expected. The difficulty with a microphone employing a diaphragm is that the diaphragm has a vibration period of its own. This tends to disrupt the vibrations of the voice or other sounds that are being put into the microphone with the result that distortion occurs. Professor Foley's microphone has two solid metal plates with an air space between them. The sound waves from the speaker's voice are directed between these plates, causing alternating condensations and rarefactions of the air. Since the air is acting as an insulator between the plates, these rapid changes in density permit corresponding electrical surges to cross the space. This sets up the electrical flutter that is necessary to carry the sound waves out into the ether as radio waves.

PLANE THAT DROPS ITS MOTOR GLIDES TO SAFETY

By pulling an emergency lever in case of fire or other danger, the motor and gasoline tanks of a monoplane designed by a western inventor, fall to the ground, and the ship may then be handled as a glider for a safe landing without the hazard of an explosion. Spring skids which are attached to the fuselage serve the purpose of forcing the lower part of the plane away when the lever is manipulated and also act as shock absorbers in alighting on the ground.



Learning to Serve Them Low by Practicing with the Double Net; One Is Set Three Feet above the Other

DOUBLE TENNIS NET HELPS IN TRAINING EXPERTS

An additional tennis net, stretched three feet above the usual one, was the device employed at a Florida court to help players learn to strike the balls just over the main net and otherwise improve their game. The usual beginner shoots the spheres unnecessarily high and often finds that the balls that just clear the barrier at the proper speed are more difficult to return.

PACKAGES TIED WITH WIRE TO PREVENT BREAKAGE

For securely tying packages with wire, a simple unit has been introduced for office and factory use. But little skill is required to operate it, the wire is firmly bound, and the ends are turned under so that they will not tear other packages.

Tying Package with Wire Held in Reel: Ends of the Wire Are Bent Under to Prevent Scratching

Copyright, Imperial War Museum

Fighting the Submarine

By LOWELL THOMAS

Author of "Raiders of the Deep," "Count Luckner The Sea Devil," and "With Lawrence in Arabia," etc.

THE World war saw modern science take its full place in the ancient art of battle. The physicist, the chemist, the engineer became the presiding geniuses of the campaigns on land and sea. The most interesting phase, perhaps, was the matching together of cold technical inventions with raw human instinct and courage and the ancient ways of man.

Take the submarine. It is the most complicated instrument of war, more so than poison gas, the aeroplane and gunnery. Put human beings, flesh and blood and nerves, courage and fear, into the iron monster which, with its complications of machinery, groped beneath the sea, and you have ultra-modern romance—one of the latest marvels of science dealing a sweeping, fearful blow that threatened to decide the issue of the world-engulfing war.

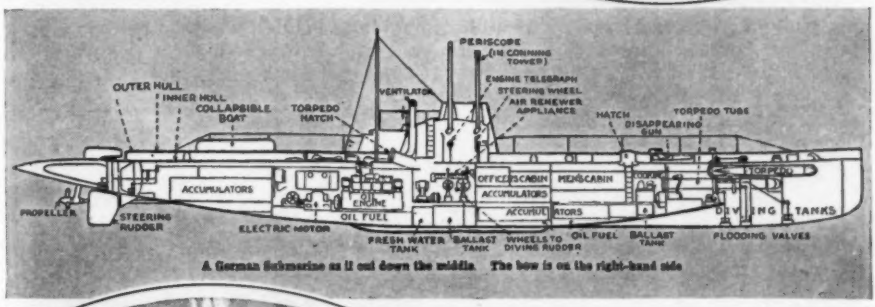
There was another aspect, too. The submarine waged a ruthless war, but its enemies struck back and fought their own campaign. If, on the German side, the U-boat war was a weird fantasy, the campaign of the Allies against the undersea raiders was full of far more variety of action, was far more picturesque, and not a whit less thrilling. Utterly different in mood and episode, but tense and vibrant, was this other side of the picture.

The plans and tricks used against the raiders of the sea were many. All the resources of science were called into play. Old schemes were tried, and new ones, gun fire on the surface, swift destroyers with special ramming bows, steel nets

View of the Sinking of the Transport "President Lincoln," from a Painting by Fred Dana Marsh; Life Rafts Were Valuable Reinforcements for the Lifeboats

studded with bombs, mines and patrol boats, lines of flares and batteries of searchlights, that cunning listening device the hydrophone, mystery ships, and a hundred other methods. Especially interesting was the warfare between modern submarine and old-fashioned fishing boat. There was a vast amount of salty romance in the conflict between the undersea wonder and the ancient race of fishermen. Was there ever more striking contrast than that? The old-time fisherman proved himself to be a formidable antagonist of this latest modernism of science.

Not long ago, I paid a visit to Lowestoft, a small port on the east coast of England. During the war it was the base of operations of the fishing fleet against the U-boats. It is a quaint old town, a good deal like the fishing villages on our New England coast. Many of the fishing craft are steam trawlers, but most are still the old sailing kind, and I saw a forest of them lying along docks and in basins. They, with their masters and crews, are the heroes of this tale of adventure.



A German submarine as it cut down the middle. The bow is on the right-hand side

Submarine Periscope—the Only Visible Part of a U-Boat on the Hunt; Section of a German Submarine, and Exploding Depth Charge

Some of the trawlers had done valiant service in the war and had come through many an epic fight against the skulking U-boats. There, on decks littered with coils of rope, nets, spars and sails, I found the old salts who had fought the submarines. One was Skipper W. S. Wharton, D.S.C., who told me the tale of how he had destroyed the German raider "UB-13."

"At that time," said he, "I had command of the trawler 'Telesia.' But of course the 'Uns wasn't supposed to know she was armed. Our gun was hidden by ports, which we could drop in the twinkling of an eye if we wanted to fire. On a midday

in March, we were trawling thirty miles east of 'ere, and George, my mate, was just washing the mess of fish over the side. All of a sudden 'e spotted a submarine and so scared was 'e that 'e dropped sack, fish and all right into the sea. When he gave the alarm I saw the sub approaching to the starboard with only 'er conning tower showing. At about two thousand yards, she dived and all we could see was 'er periscope. Suddenly she turned and made off in another direction after a steamer. But about 'arf past four in the afternoon, blimey if there wasn't that periscope right off our port bow, only two hundred yards away. A moment later a torpedo came bouncin' right at us. If it 'ad been a 'it, we'd a been blown clean out of the water. But it missed us by a couple of feet.

"All that time we kept banging away at 'er periscope. Then another torpedo came along, but it also went wide. I guess that must 'ave irritated the skipper of the U-boat because 'e came right up to shoot it out with us with 'is guns. Before the Germans 'ad time to crawl out of their hatch we let go with our gun at about a hundred yards' range and got 'er square in the foredeck. Over she went on 'er side, 'er propeller rose out of the water and down she went to Davy Jones.

"We were all yellin' like wild men. The 'Telesia' had bagged a submarine in her first fight. 'Blimey if we didn't forget to put up our flag!' shouted the mate. You see, our orders were to run up the British ensign before action to keep from be-'avin' like pirates. But you know when a blighter sees a U-boat coming at 'im full speed, there is not much time for polite formalities, is there?"

And then Skipper Wharton told me another tale in which he was accompanied by one of his pals who has become almost a legendary figure among the fishermen of the east coast of England.

Photograph of the Interior of German Submarine "U-58," Showing the Higher-Powered Engines on Each Side; Utilization of Every Inch of Space Is Essential in Submarine Design

Firing Two Depth Charges from a Y-Gun on United States Destroyer; Depth Charges Were Given the Derisive Name of "Ash Cans," but Their Effectiveness Was Highly Respected

"It was in February, 1917, just a year later," he said. "The Germans were in the midst of their unrestricted U-boat war and sinkin' everything on sight. This time I was in command of the smack 'Boy Alfred.' Not many yards away from us was Tom Crisp with 'is smack, the 'I'll Try.' Well, we saw two submarines bearin' down upon us. One of the U-boats got close enough so we could take a good look at 'er and she was a big un, a mine layer I guess, and two of 'er crew were on the conning tower in their blue monkey jackets and blue-and-white stocking caps, waving a flag and signaling us to come alongside.

"'Leave your ship,' the 'Un commander sang out. 'I'm going to torpedo you.' I pretended I couldn't understand, so we'd 'ave a chance to move a little nearer. At the same time I motioned to my men to lie down by the gun. Then, just as the German skipper shouted through 'is megaphone again, I sang out, 'Let go, Duffer,' and the men jumped to the gun, pulled the fake port aside and let drive. The first shot missed, but the second got 'im square under the conning tower, and so did the third. Those two bursts almost tore the 'Un in two, and down 'e went like a stone.

"In the meantime, the second submarine 'ad submerged and now we could see its periscope snaking toward us some two hundred yards off our starboard quarter. She was right between us and Tom Crisp on the 'I'll Try,' so we were afraid to fire for fear of missing and sinking Tom. Just then up came the German, and the 'I'll Try' cut loose. Her first shot crashed into the U-boat right below 'er foredeck, and down she went by the 'ead. Tom Crisp marked the spot with a buoy and we sent two pigeons to Lowestoft with the news."

Tom Crisp is dead, now, and Skipper Wharton's chief rival for first honors among the fishermen is another old salt known as "Fifty - two twenty - nine" Thompson. They call him that because they say it is the only latitude and longitude he knows.

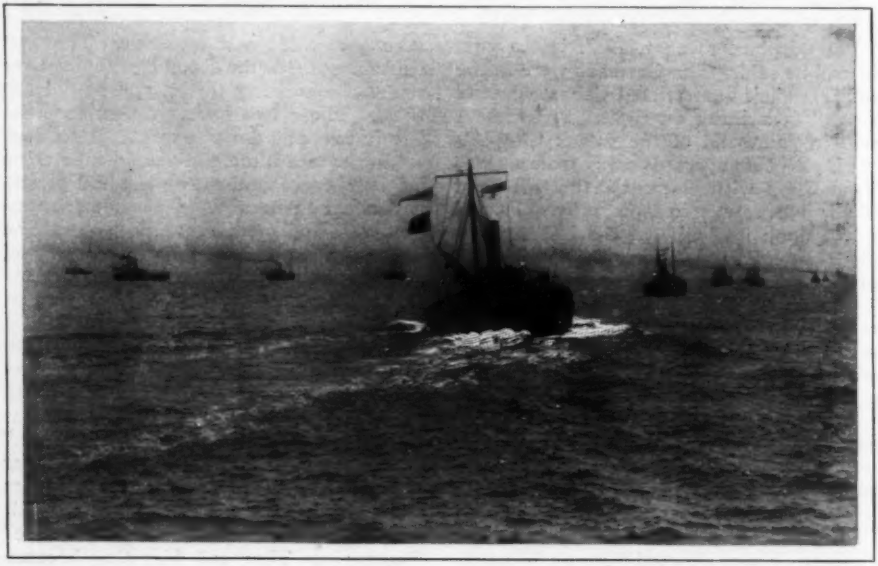
"It was when I was in command of the 'Cheerio' that I'm tellin' ye about," said he. "We was 'avin' our tea, when George, who is listenin' at the 'ydrophone, 'e says 'e 'ears a buzzin' noise right under us. Now Hi wasn't sayin' as 'e didn't, but Hi wasn't gettin' too excited about it. You see, 'arf the time that blighter George was as cockeyed as a bloater. But this time when Hi listened in myself Hi found 'e wasn't so bloomin' cockeyed. Sure enough, there was a U-boat buzzin' along steadylike under us. That went on for about three-quarters of an hour, when all of a sudden our steel net stretched tight. Then she eased up a bit and blimey if Hi didn't think we'd lost 'er. Then the net tightened again, there was a terrific explosion under the surface, and the sea rose into the air like a waterspout right in front of us. It 'adn't 'ardly settled down when there was a second explosion.

"When we tried to 'aul in the nets we couldn't even budge them. A moment later they were torn right away from the 'Cheerio' and up came a lot of oil and steel. That was all we ever found. But later our victory was confirmed and we found that we 'ad caught and sunk the 'UC-3' a 'Un who 'ad come over from Flanders to plant mines.

"My second go with Fritz was on the surface. One day a U-boat pops up in pline sight of us. Of course 'e didn't know we 'ad a gun. When 'e opened on us we let 'im 'ave it. Our steward was down in the 'old throwin' up boxes of thirteen-pound shells like they was doughnuts. Any other day when 'e 'as to 'andle them 'e 'owls, 'Come on, you blighters, gimme a hand with these blarsted things.' But now 'e's strong as a lion and tossin' em up a whole box at a time.

"We were mighty excited, but somehow it didn't seem to spoil our aim and with their shells whistling through our whiskers we kept on pepperin' until the sub blew up and went down with nothin' left to show for 'er hexcept five men swimmin' around in the water. They were 'ollerin' for 'elp, but we couldn't fish 'em out in time. When we got back to port, the Hadmiralty they gave us five pound a head for all the men that made up the crew of the U-boat we 'ad sunk. Blood money, we calls it."

But the story all the fishermen are keenest to tell is the tale of how Tom



Copyright, Imperial War Museum

British Drifter Fleet Flying the White Ensign of War; Armed Fishing Craft, Such as These, Proved Formidable Antagonists to Some of the Submarines

Crisp went down on the smack "Nelson." Tom stands a mythical figure in the conflict between the old and the new in the North sea. He was a jovial, blustery fellow, but on his last cruise he was in a glum mood because of the recent death of his wife. While packing fish, he saw a faint shape on the horizon.

"Hand me my glasses," he sang out to his son. The object he saw was a German submarine bearing down upon him.

Just as Tom Crisp shouted, "Clear for action," the first German shell came whining over the water, followed by a second and a third. These were intended as a signal to abandon ship. But Tom Crisp did not mean to do anything of the sort.

The fourth shell from the U-boat caught the smack in the bow, right under the waterline, and she started to sink.

"Put her about!" Tom Crisp shouted. A moment later he was hurled to the deck, terribly wounded, and then another shell tore away both his legs.

"Take the tiller," he called to his son. And then the fight went on, with shells crashing into the little sailing ship while the plucky skipper urged his gunners to stick to their posts.

"We're done in," the old salt panted as one of his crew leaned over him. "Better send in the birds."

Then he dictated the message: "'Nelson' attacked by submarine. Skipper killed. Send help."

The water was up to the gun bridge now, and only three shells were left.

"Throw over the books," the skipper ordered then, "and lower the boat. It's your only chance. No, don't wait for me. I'm done in." He ordered the others off, motioning them away peremptorily when they tried to move him to the lifeboat. The little boat made off, and five minutes later gallant Tom Crisp went down with his smack.

There still remained the other smack, the companion of the luckless "Nelson." Now the submarine turned its shells to the "Ethel and Millie." Skipper Manning, like Crisp, was outranged by the enemy's gun, and took to his boat with his crew. He was ordered on board the submarine with his men. They were aboard the U-boat when it was sunk with all hands.

(To Be Continued)

Apparatus by Means of Which Light Waves Are Made to Carry Sounds to a Distance

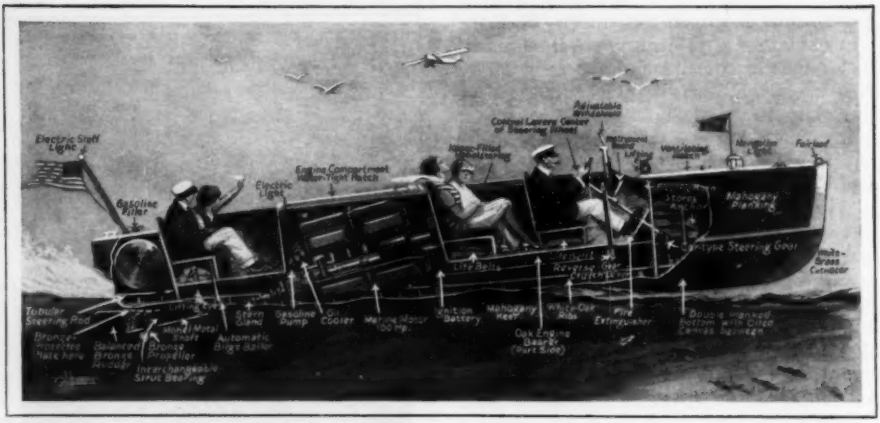
SOUND SENT ON LIGHT WAVES WITH SIMPLE SET

Sound is successfully transmitted over light waves on an apparatus developed by John Bellamy Taylor. The sending unit is equipped with an electric phonograph pick-up, and the receiving apparatus has a loud speaker.

WRENCH WITH INSULATED GRIP PREVENTS ELECTRIC SHOCKS

For putting nuts on starter switches, and for other tasks around electric units, a ratchet wrench with an insulated rubber handle has proved efficient and especially desirable, as it protects the user against shocks. It is shaped to reach relatively inaccessible parts of the car.

Ratchet Wrench with Heavily Insulated Handle for Automobilists to Prevent Shocks



Sectional Drawing of a Popular Make of Fast Motorboat, Showing Position of the Engine, Propeller Connections, and Storage Space for Life-Saving Equipment

SECRETS OF FAST MOTORBOAT REVEALED BY "DISSECTION"

The relative positions of the fuel tank; the motor, the steering gear, and other interesting details, of a popular make of motorboat are clearly revealed by a sectional sketch an artist has prepared. The drawing clearly shows how space is carefully utilized and how the boat is balanced and designed for the greatest speed. Compartments for stores, life belts and anchor, and the inclined position of the motor are features that the layman, seeing only the boat's outside, rarely is aware of.

HUGE "CARPET SWEEPER" KEEPS STREETS CLEAN

Streets are cleaned with less dust and discomfort in Berlin with a motor-driven sweeper somewhat like the familiar carpet sweeper on a large scale. Dirt is picked up and deposited in an inclosed compartment which can be emptied later.

It Picks Up the Dust without Scattering It; Huge Street Sweeper Used in Berlin

"HEARTBEATS" IN PLANTS DUE TO SHAKING INSTRUMENTS

Plants have no beating pulse that propels the sap upward, and such pulsations as have been recorded are due to the trembling of improperly adjusted instruments and not to the beating of the plant, experiments recently performed by several American and European plant physiologists indicate. The findings are directly in conflict with those of Sir Jagadis Chunder Bose, who announced, some time ago, the "beating-heart" theory in regard to plants as a result of measurements with his instruments. Apparatus exactly like that used by the Indian investigator was set up and used by Dr. G. A. Persson, of Mt. Clemens, Mich., a physician interested in the effect of strychnine and other drugs on the "heart action" of plants. He reported that he did get irregular tracings on the recording apparatus, markings that Doctor Bose interpreted as the beating of the plant's heart, but he declared that, when he carefully insulated his instruments against vibrations and electrical disturbances, shielded them from air currents and refrained from walking near his plant, the apparent pulsations stopped completely. Similar results, agreeing with those of Doctor Persson, were obtained

by Prof. H. H. Dixon, of the University of Dublin. He has developed an interesting theory as to why sap ascends in a tree. By experiment, he has demonstrated that a continuous column of water in a sealed vessel, has a strength like a woven rope, resisting a breaking strain of several hundred pounds per square inch. This is sufficient to pull sap to the top of the tallest tree. Evaporation at the leaf surfaces supplies the pull, he found.

CARRIAGE FOR CABLE LINES PASSES CROSS WIRES

Use of cable lines for transportation purposes will be extended, it is predicted, as the result of the development of an improved carriage which permits passing over supporting cross wires. This has been a problem heretofore as cables had to be suspended over limited areas without supporting wires in order that there would be no obstruction for the carriage that held the load. The new carriage has a movable spider which automatically unlocks and makes a quarter turn, allowing the cross wire to pass through. Logging and other industries are expected to make wide use of the device.

Latest Aid for the Cable Carrier; a Carriage That Permits Crossing Support Wires

Courtesy Ewing Galloway

Lowering Person on Fire Ladder in the Sled Arrangement; It Prevents Falls

LIFE SLED ON FIRE LADDER AIDS IN RESCUES

To rescue persons from burning buildings, a sliding frame, to which the victim is strapped and lowered with rope, has been devised by a German for the fire ladder. The system is considered safer and more efficient than the usual way of carrying persons down. The straps are easily adjusted and prevent the occupant of the carrier from falling out.

AUTOS IN UNITED STATES TOTAL OVER TWENTY-FOUR MILLION

Nearly 1,360,000 more motor vehicles were registered in the United States last year than in 1927, the bureau of public roads announced recently. The grand total for 1928 was 24,493,124, an increase of 5.9 per cent over the year before. The figures are based on state registration reports and cover all types of motor vehicles except trailers and motorcycles. Automobile owners paid the states and the District of Columbia a sum of $322,630,025 in license, registration, permit and other fees.

With the Zeppelin's

The Starboard Radial Engine on One of the Goodyear-Zeppelin Fleet of Baby Airships; Note the Single Landing Wheel

IF YOU want to locate a school of fish, find rare plants, spray a fruit grove, rescue a man from drowning, or search for a missing boy, the small-size airship—little brother of the Zeppelin—will help you do it.

The small non-rigid airship or dirigible, sometimes referred to as a "blimp," has been put to many odd uses. And Jack Boettner, "Admiral" of the Goodyear-Zeppelin corporation's fleet of baby airships with headquarters at Akron, Ohio, predicts that many more jobs will be found for it in the future. Boettner is considered one of the world's leading pilots of lighter-than-air ships.

Last winter, one of the most baffling kidnaping cases on record stirred northern Ohio. A four-year-old boy mysteriously disappeared. Hundreds of school children and adults searched the surrounding country in a vain effort to find the boy, devoting many days to the task. But a quartet of men, flying at low altitude in the "Puritan," an 86,000-cubic-foot non-rigid airship, made a much more thorough search in a few hours. Later, on two occasions, Boettner used the same ship in searching a lake where it was thought the boy's body might be found.

"A small dirigible provides an ideal means of quickly inspecting a large area," Boettner explained, in telling of the search. "Of course, in the summer when trees are in leaf, it is often impossible to see things on the ground. But in winter a moving object, freshly dug earth or any other thing on the surface of the ground is easily detected. With a dirigible, it is a simple matter to drop low and remain practically motionless for a detailed study of a particular spot. When searching a lake, the observer can see anything in the water, providing the bottom is sandy. If the lake has a dark bed, however, only light-colored objects are easily located."

The ease with which objects in the water can be seen from the air accounts for the misfortune of a good many submarines during the war. But a more recent activity along the same line is the locating of fish. The "Pony Blimp," first of the

Little Brother

The "Puritan" Sails Out to Meet the "Leviathan," as the Liner Nears New York, and Deliver a Message to an Official of the Company; the Picture Is a Contrast in Size

baby airships built in 1919, was found well adapted for ocean fishing. The flying angler simply cruised about over the water until he sighted a school of fish, and then descended to the surface and began hauling them in.

The day when you will have your groceries delivered by a blimp, as a popular comic strip has depicted, was anticipated not long ago by Boettner when he safely deposited a passenger on the roof of a store. Since then, he has duplicated the performance. At one time he hovered over the post-office building at Akron while a mail sack was attached to a dangling cable. Then he carried the sack in record time to a mail plane waiting at the airport, four miles distant.

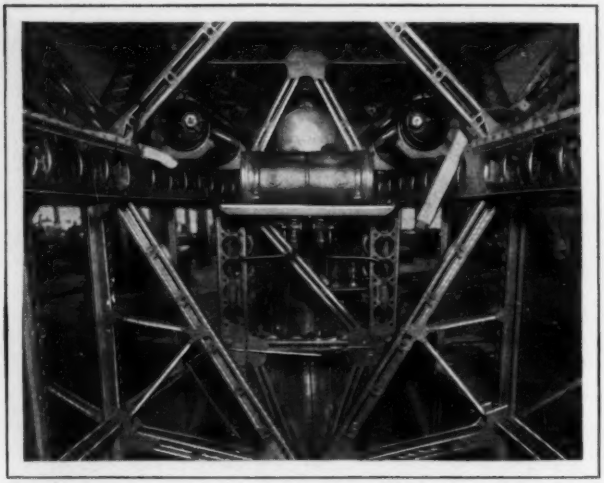
Landing on a building, while seemingly a simple matter, nevertheless has its ticklish moments, according to Boettner. A sudden gust of wind can send the gas bag against the side of a neighboring structure, or cause it to swing dangerously near flagpoles, elevator shafts, or the roof itself.

All kinds of things have been delivered in the little airships of the Goodyear fleet. On a visit to New York City the "Puritan" dropped a message of greeting to the "Leviathan" as the liner was still some distance from land. One Christmas the "Pilgrim" substituted for Santa's reindeers in carrying gifts, which were dropped, attached to parachutes, to youngsters in a children's home.

If you were marooned on a cake of floating ice or a tiny island, the airship would be an ideal instrument for rescuing you. Last winter, as a demonstration of the dirigible's life-saving ability, the "Puritan" rescued a man stranded on a frozen lake. The ship merely came down to the ice surface while the castaway climbed aboard, and then rose into the air again.

"I see no reason why a small airship should not be used for coast-patrol work," Boettner declared. "It would be relatively easy to pick up a drowning man who could not be reached in any other way. The ice rescue has demonstrated that. But in the past, a dirigible has never been available when there was rescuing to be done."

The baby blimp, which at present would cost as much as or more than a large



Interior of a Blimp's Cabin during Construction; the Lightweight Metal Girders Are Typical Also of the Big Zeppelins

airplane, is not considered as a competitor of the heavier-than-air machine for usual types of commercial work. However, there are many tasks it can perform where the airplane would be useless. The blimp's slow speed and small useful load may be a disadvantage on one hand, but its ability to hover indefinitely over a given spot, at any altitude, more than overbalances this handicap in many instances.

Can you imagine a more ideal location than the cabin of a dirigible from which to photograph a parade, a football battle, or a new allotment? The cameraman can shoot to his heart's content while the airship remains practically motionless at the best height. Slow shutter speeds and smaller lens openings insure better pictures than are possible when a swift-moving airplane is used. Needless to say, the photographic abilities of the baby blimps have been utilized often.

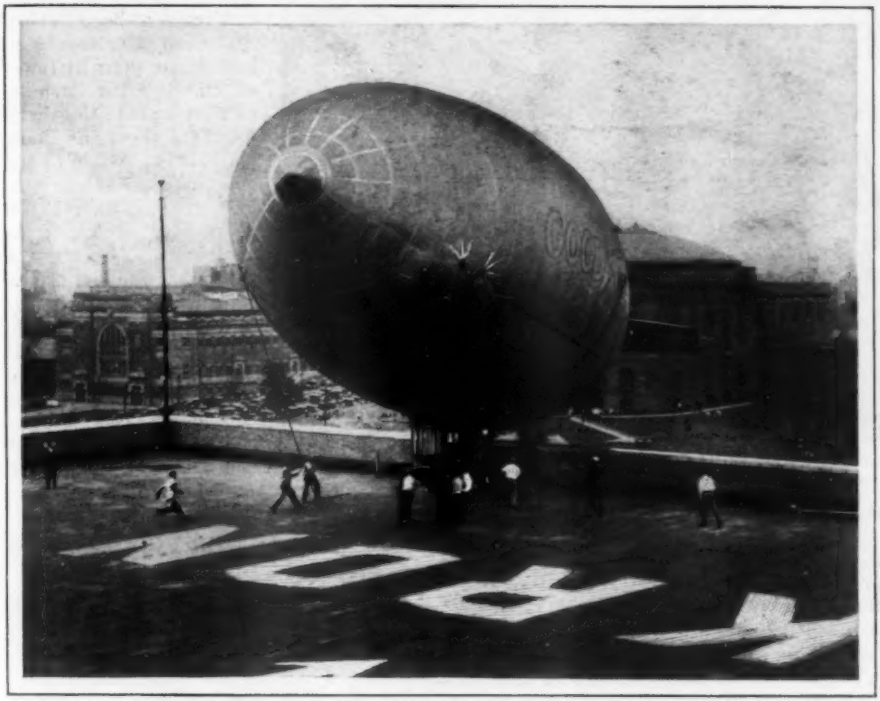
Recently Boettner received a letter from the operator of a large lumber mill in Idaho. The company, it seems, is about to work a vast tract of virgin timber which extends about the mill for a fifty-mile radius. It is necessary to study this land in order to determine just what kind of trees and approximately how many of each are available. To do this by usual methods would require months, perhaps years. An airplane has been tried, but it moved too fast and could not fly low enough with safety. Would a small dirigible fill the bill?

"Yes," Boettner answered. "With a baby blimp you can cruise slowly at a low altitude—grazing the tree tops if necessary—and do the work in a few weeks. Trees can be identified and routes for roads to be cut can be determined with ease."

On the heels of the lumber operator's request came another. A landscape gardener doing business in Erie, Buffalo, Cleveland, and other centers, found it necessary to obtain rare plants and trees from various wooded sections, most frequently from the mountains of Pennsylvania. In the past, he had spent days searching on foot, or in an automobile when possible. This proved too slow, so he tried an airplane. Hopeless! The plane's speed and necessarily high altitude prevented his seeing and recognizing the desired specimens. Then the searcher thought of the dirigible, and wrote to Boettner. The result is that the man will be taken on an air jaunt over Pennsylvania hills where he will be able to determine for himself whether the baby blimp is superior to the foot.

There are many other jobs to which the airship of less than 100,000 cubic-foot gas capacity is peculiarly adapted. For one thing, it has been suggested as a means of spraying large forest areas in the east in an attempt to destroy a certain moth pest. It would also be useful for spreading poison on cotton fields or orchards. If the country is hilly, it is far superior to the airplane in such work. Spreading of oil on stagnant pools to kill mosquitoes could easily be done. Making of crop surveys is still another possibility.

A baby blimp is about one-seventy-fifth as large as the new navy Zeppelins will be. But the two extremes in airships are flown in very much the same way. For this reason, the blimps are ideal for train-

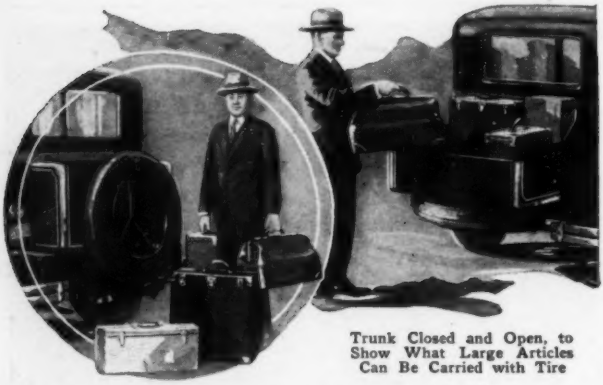


The "Pilgrim" Making a Landing on the Roof of a Department Store in Akron; the Little Ships Are So Easily Handled They Have Been Used for Deep-Sea Fishing Expeditions

ing purposes. A student pilot of lighter-than-air craft has much more to learn than his brother who sticks to airplanes. The dirigible man must know, in addition to the usual things an airplane pilot learns, all about hydrogen and helium gas, buoyancy, ballast, inflation, the behavior of a large gas bag in the air, and other things. His theoretical training is extensive. His actual flight experience is gained first in free balloons. Every dirigible pilot first must qualify as a balloon pilot. The next step is a promotion to the small airship. Here he learns to fly expertly the little ships, which are virtually free balloons with motors and controls added. Perhaps the student will decide to stick to blimps. Or he may go on, receiving additional training on a larger craft. Several years ago Zeppelin engineers suggested that a training ship—a real rigid dirigible on a small scale—be built and used as a "flying schoolhouse." This may be done if the interest in huge air liners warrants.

At the present time, the job which the small dirigible does best is advertising. It is new enough to draw large crowds. In fact, there are millions of people in the United States who never have seen an airship, and many others who never witnessed the interesting process of landing one or taking it from its dock for flight. On a calm day Boettner can land his ship without any crew other than the people in the craft. With dirigibles of the "Puritan" type, there are, at most, four persons. When there is a moderate or light wind, a ground crew of six men is required. Heavier winds increase the number to fifteen or sixteen. During the several cross-country flights of the "Puritan," a ground crew of fifteen men, preceding it in a truck, was found adequate.

Airship travel is one of the safest of the many modern forms, according to leading authorities. The "Puritan's" record tends to prove this. The craft never has suffered a mishap.



Trunk Closed and Open, to Show What Large Articles Can Be Carried with Tire

FOLDING-TRUNK AUTO CARRIER ALSO HOLDS TIRE

Installed on the rear of the car, an attractive luggage carrier, shaped like a trunk, unfolds without being removed so that the contents easily can be taken out or the holder packed. A built-in tire carrier is also provided. The trunk, which is finished to match the car, can be used for holding salesmen's sample cases, picnic luncheons, merchants' orders and various farm articles, such as milk cans, etc.

MUD BANKS RECORD WEATHER MANY CENTURIES AGO

Nature has kept a sort of weather record on deposits of fine-grained clays, geologists have discovered, so that it is possible to estimate what temperature and other conditions were when the cavemen hunted reindeer in Europe. C. F. Marvin and A. J. Henry, of the weather bureau, recently explained these natural records and how they are interpreted. The soil deposits are known as "varve clays," and were laid down by streams, pouring from the melting glaciers into lakes and ponds, and bearing loads of silt which they dropped when they reached still water. If the streams were swollen, they carried heavier particles, making a coarse layer. In summer, they bore less silt, and the particles were finer, making a closer-grained layer on the bottom. Each year's record is thus represented by one of these composite layers, grading from coarse in the spring to fine-grained in the fall. In the years of heavy rains, a thicker layer would be laid down than in times of comparative dryness, so that by counting back on these sheets of varve clays, it is possible to tell what the weather was like more than 10,000 years ago, according to geologists. The strata show that the last of the glaciers in northern Europe melted about 6500 B. C. Other evidence of the weather in past times is obtained from the rings on the California and other large and ancient trees, although these records do not go nearly so far back as do those in the clay banks.

VACUUM CLEANER PICKS FOWLS SAVING TIME AND WORK

Feathers are quickly removed from chickens and other fowls with the aid of a combination suction and picking device, introduced in England. A strong air current separates the feathers and draws them into a large sack while rotating "catchers" pull them out, the fowl being held against the grill. The machine is said to remove fine down as well as the larger feathers, and does not damage the skin of the bird.

Cleaning a Fowl with the Suction and Picking Outfit That Removes Large and Small Feathers

FRUITS ARE RIPENED BY GAS TO AID GROWERS

From ancient times, when the Chinese ripened hard pears by placing them in a tightly closed room and burning incense around them, fruits of various kinds have been matured artificially by one means or another, after an early picking, to insure better quality and flavor and to aid the grower in marketing. Recently, the use of ethylene gas in ripening fruits has been developed to a high degree of success by

Prof. R. B. Harvey; Banana Room Fitted to Maintain a Suitable Temperature and Humidity and Gas-Tight to Prevent Escape of Ethylene, and Top of Container with Measuring Gauge

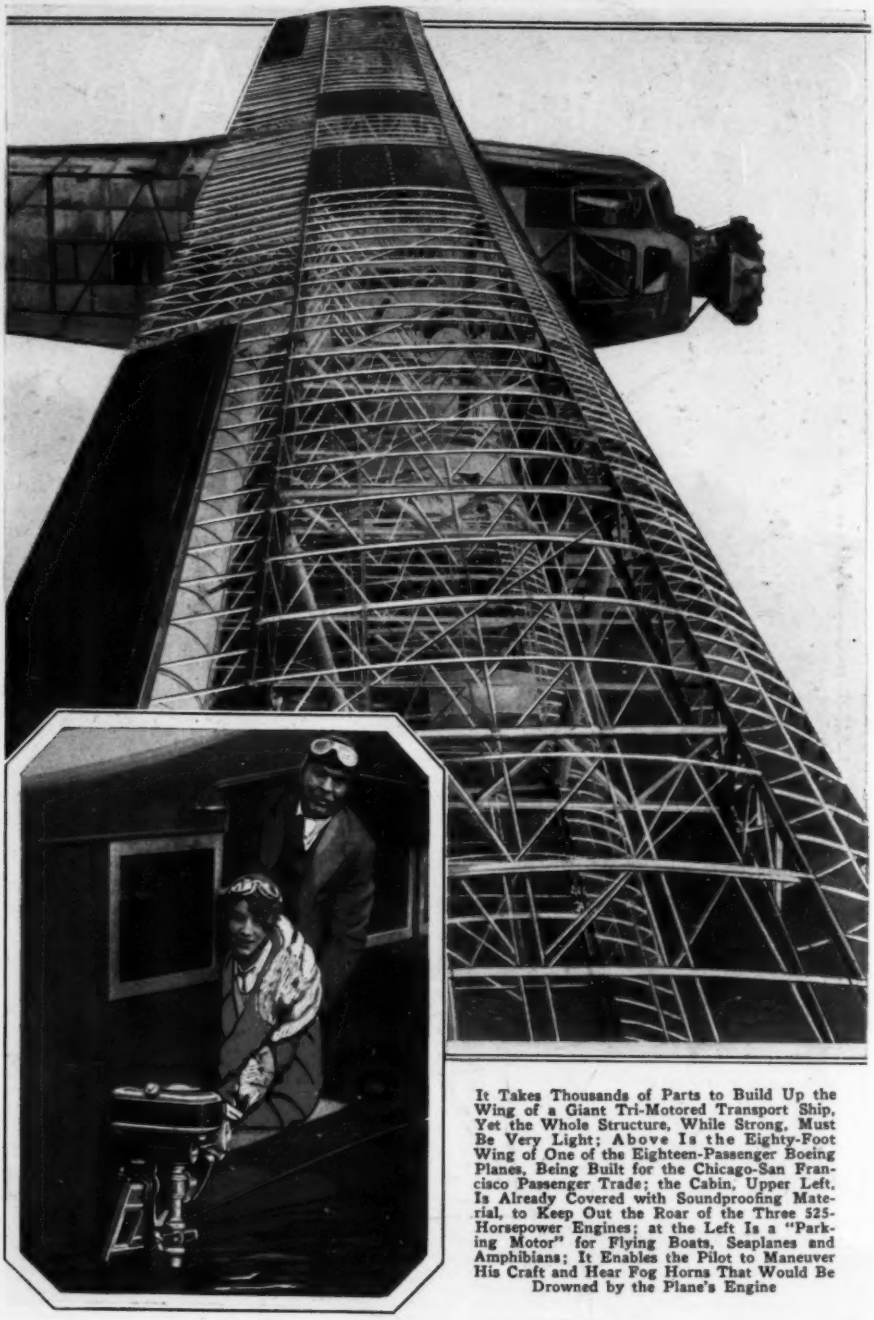
Prof. R. B. Harvey, of the University of Minnesota, and others, so that the process may be applied with little difficulty, with certain results and at a small cost. The equipment, besides the room itself, can be obtained for $30, or less, and gas enough to ripen a carload can be purchased in a cylinder from supply houses for fifty cents. The room used for the ripening operations should be well constructed to prevent leaks; the temperature should be accurately controlled and one cubic foot of gas should be used to each 1,000 cubic feet of air space in the room. The cylinders should be kept away from flames and a special valve is needed for measuring the flow of gas to insure the correct mixture with the air. The concentration necessary for ripening fruits is so low that, within a minute or two after closing the valves, fires may be lighted with safety. Bananas, tomatoes, celery, pineapples, cantaloupes, oranges, limes, lemons and grapefruit are among the products that have been treated on a large scale and successfully with ethylene.

America's Biggest Air Liner, Now under Construction, Is This Four-Motored Fokker, with Berths for Sixteen or Seats for Thirty-Two Persons

The World in the Air

Planes Are Dedicated with a Bottle of Water; Miss Bobbie Trout, Twice Holder of the Endurance Record for Women, at the Left, and Miss Ruth Elder Officiate at Los Angeles

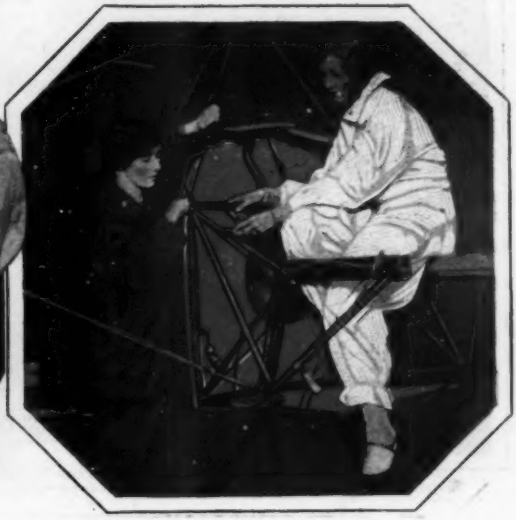
With a Pear-Shaped Wing and the Propeller Revolving in a Slot, This Monoplane, Built by a Long Beach, Calif., Enthusiast, Represents a Radical Departure from the Conventional Design



It Takes Thousands of Parts to Build Up the Wing of a Giant Tri-Motored Transport Ship, Yet the Whole Structure, While Strong, Must Be Very Light; Above Is the Eighty-Foot Wing of One of the Eighteen-Passenger Boeing Planes, Being Built for the Chicago-San Francisco Passenger Trade; the Cabin, Upper Left, Is Already Covered with Soundproofing Material, to Keep Out the Roar of the Three 525-Horsepower Engines; at the Left Is a "Parking Motor" for Flying Boats, Seaplanes and Amphibians; It Enables the Pilot to Maneuver His Craft and Hear Fog Horns That Would Be Drowned by the Plane's Engine

The Navy Has Ordered Two Giant Dirigibles, Bigger Than Any Yet Built, and This Shows How They Will Compare with a Battleship; Note the Gun Turret on the Side and Others on Top near the Bow and Stern; the Guns Will Be Used to Repel Airplane Attacks

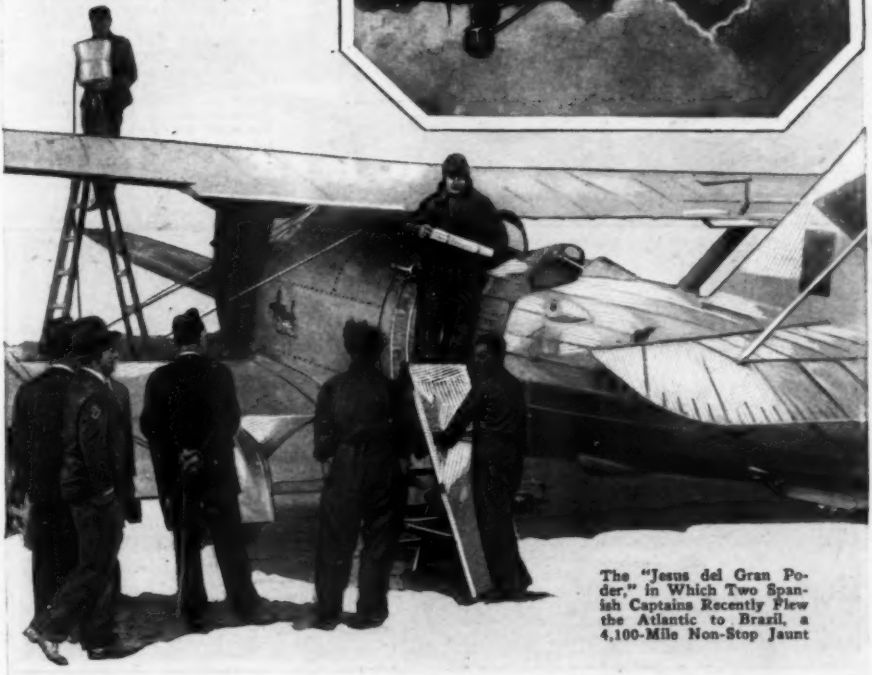
Elinor Smith, the Seventeen-Year-Old Flying Miss of Long Island, beside the Bellanca with Which She Set Up a New World's Endurance Record for Women, and, at Right, a Pair of Girl Students in a Chicago Flying School, Working on the Motor Mount of a Ship Being Assembled



When the Night Express Comes In at the Oakland, Calif., Airport; the Photograph Above Was Made by the Light of the Field Flood Lamps; Modern Cabin Ships, as at the Left, Are as Well Appointed as the Finest Automobiles; Deep-Cushioned Seats, Velour Upholstery, Auto Fittings and Hardware, Including Vanity Cases, Smokers' Outfits and Cigar Lighters Are Some of the Things That Go to Make Aerial Transportation Pleasant; the United States Leads the World in the Development of Small and Medium-Sized Cabin Planes, Carrying from Two Passengers Up to Six or Eight

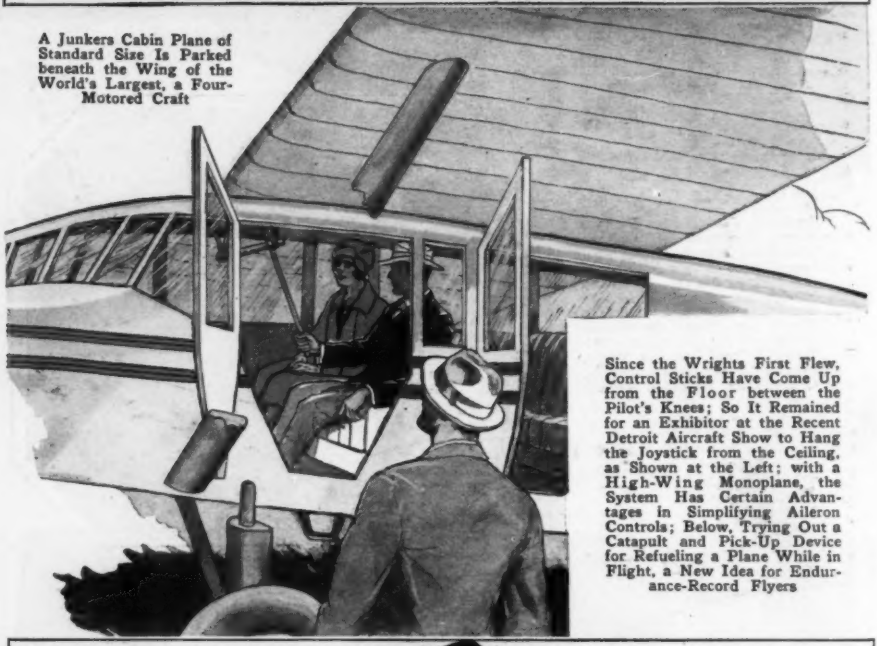
Class in Plane Building at Lane Technical High School, Chicago, Demonstrates the Newest Addition to the Curriculum

Anthony Fokker, the Famous Dutch Designer of German War-Time Planes, Has Transferred Most of His Activity to the United States; Above Is His Latest, an Eight-Passenger Amphibian, with Sleeping Berths for Two; the Transcontinental Air Transport's Tri-Motored Ford, at the Right, Is Colonel Lindbergh's Flying Office as Its Technical Advisor

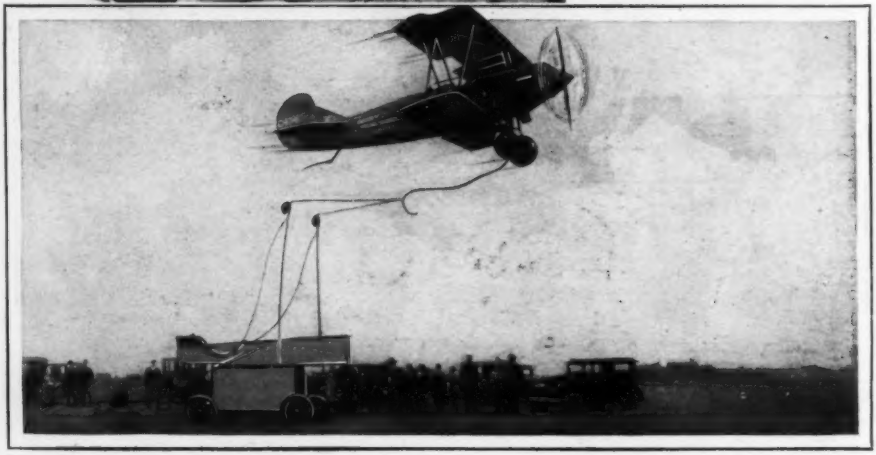


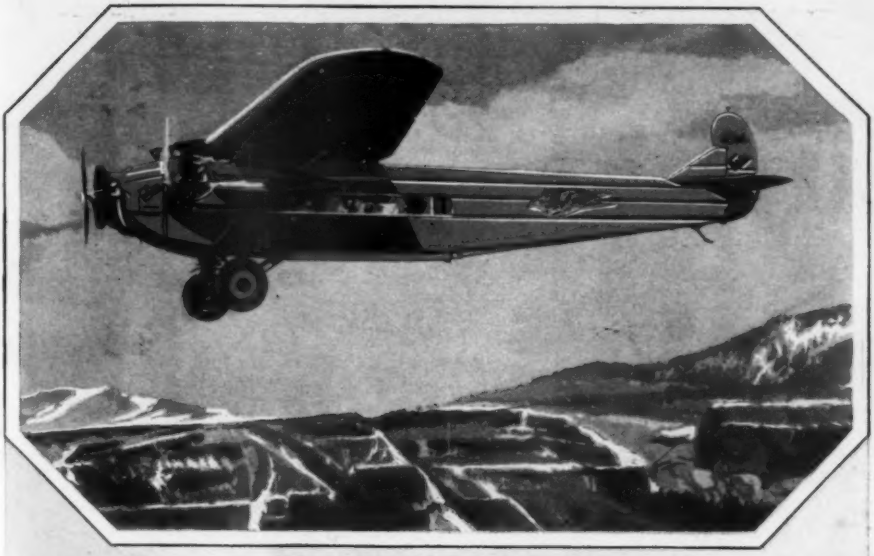
The "Jesus del Gran Poder," in Which Two Spanish Captains Recently Flew the Atlantic to Brazil, a 4,100-Mile Non-Stop Jaunt

A Junkers Cabin Plane of Standard Size Is Parked beneath the Wing of the World's Largest, a Four-Motored Craft



Since the Wrights First Flew, Control Sticks Have Come Up from the Floor between the Pilot's Knees; So It Remained for an Exhibitor at the Recent Detroit Aircraft Show to Hang the Joystick from the Ceiling, as Shown at the Left; with a High-Wing Monoplane, the System Has Certain Advantages in Simplifying Aileron Controls; Below, Trying Out a Catapult and Pick-Up Device for Refueling a Plane While in Flight, a New Idea for Endurance-Record Flyers

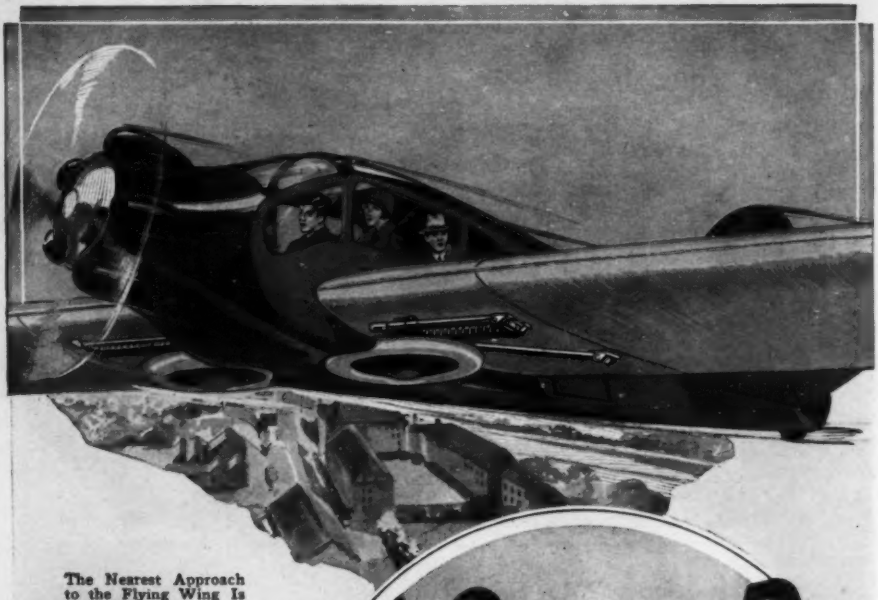




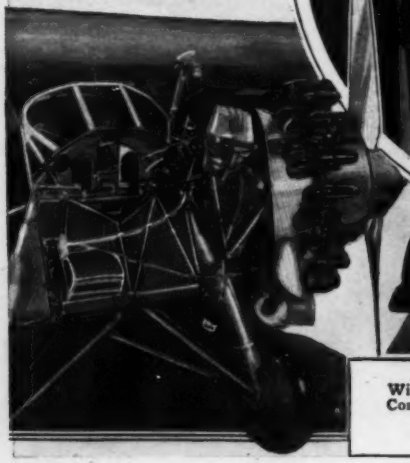
A Fokker Tri-Motored Transport Flying over the California Mountains; Type Is Much Used on American Lines

The New Bellanca in Flight; the Curiously Curved Struts of the Landing Gear, Designed to Permit Vertical Action of the Shock Absorbers, Are a Distinctive Feature

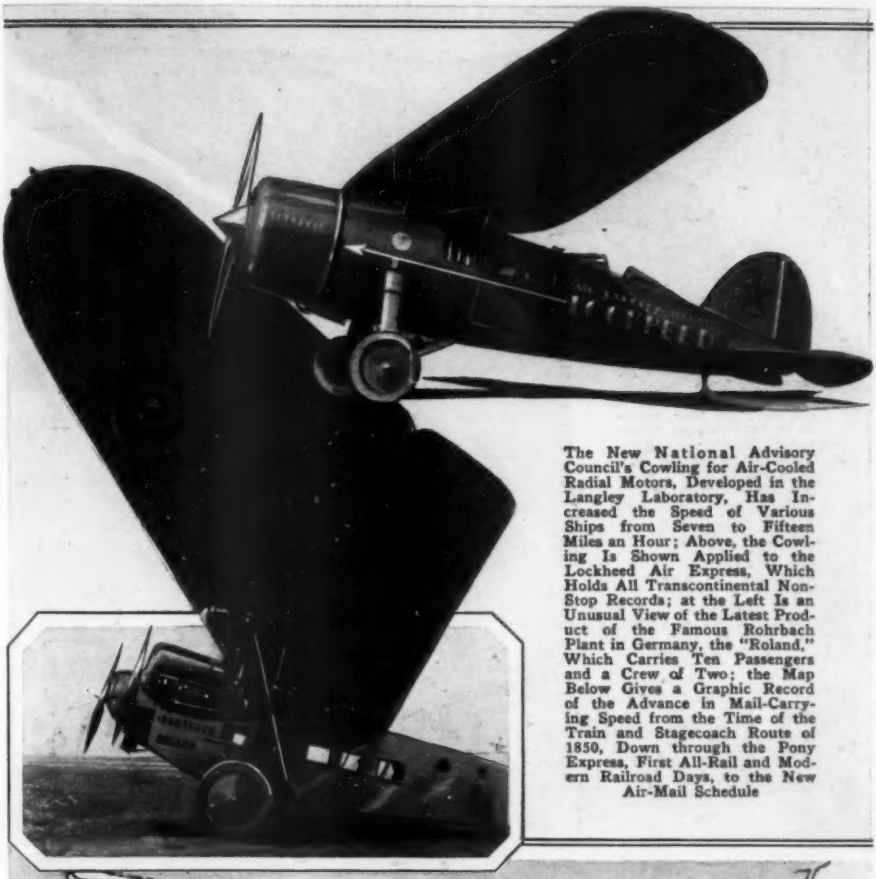
In an Air That Has Been Almost Usurped by Air-Cooled Engines, Water-Cooled Motors, Largely War-Time "OX-5's," Still Find a Place in Training Ships; This Is One of the Lincoln-Page School Ships



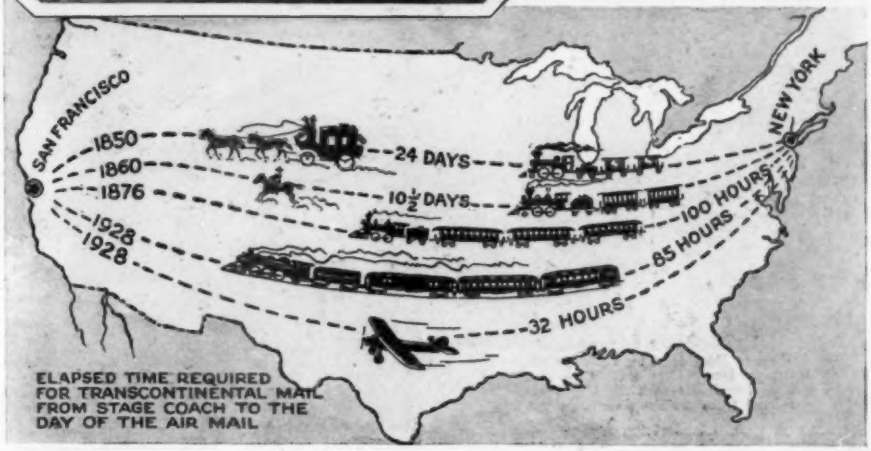
The Nearest Approach to the Flying Wing Is Don Alexander's New "Bullet" Plane, with a Retractable Landing Gear Which Is Drawn Up into a Streamlined Housing, to Reduce Wind Resistance While in Flight; Built for "Four Passengers and a Dog," This Is the Thirty-Two Model; Other Bullet Planes, Numbered in Gun Calibers, Will Be Twenty-Two and Forty-Five

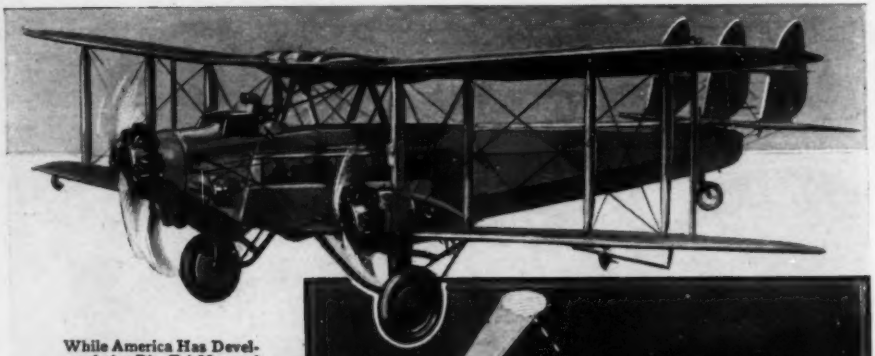


Winners in a Philadelphia Model-Plane Contest, and, at Left, the Knoll Plane, with a Hinged Motor Mount

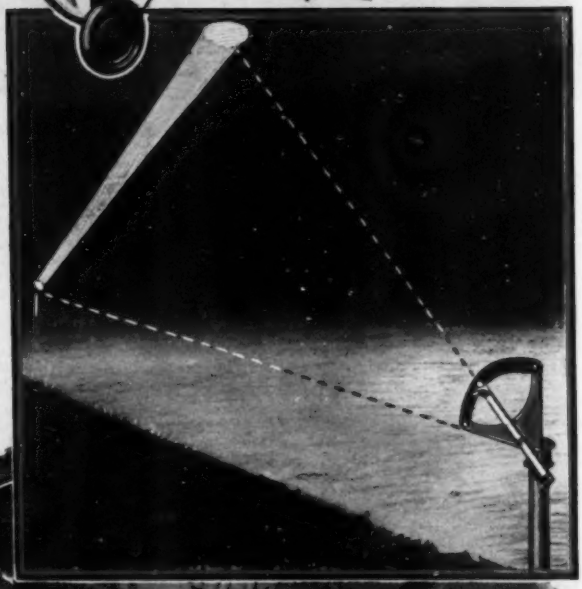


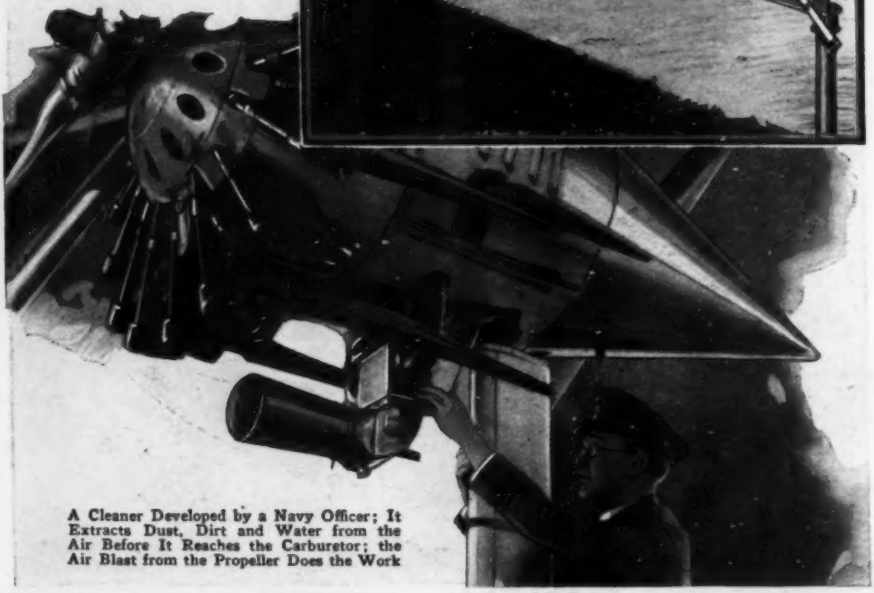
The New National Advisory Council's Cowling for Air-Cooled Radial Motors, Developed in the Langley Laboratory, Has Increased the Speed of Various Ships from Seven to Fifteen Miles an Hour; Above, the Cowling Is Shown Applied to the Lockheed Air Express, Which Holds All Transcontinental Non-Stop Records; at the Left Is an Unusual View of the Latest Product of the Famous Rohrbach Plant in Germany, the "Roland," Which Carries Ten Passengers and a Crew of Two; the Map Below Gives a Graphic Record of the Advance in Mail-Carrying Speed from the Time of the Train and Stagecoach Route of 1850, Down through the Pony Express, First All-Rail and Modern Railroad Days, to the New Air-Mail Schedule





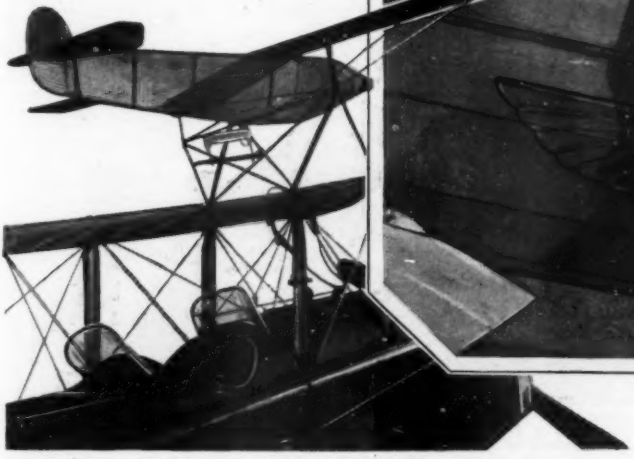
While America Has Developed the Big Tri-Motored Transport Monoplane for Passenger Lines, the English Lines Still Favor a Biplane; the Ship Above Is a DeHavilland "Hercules," Used on the Cairo-India Section of the New Mail and Passenger Service from London to India; Short "Singapore" Flying Boats Fly the First Section of the Line; at the Right Is a New "Ceiling Indicator" Which Measures the Height of Clouds on Which the Light Beam Falls, and Gives the Aerial Ceiling in Terms of Feet in a Direct Reading



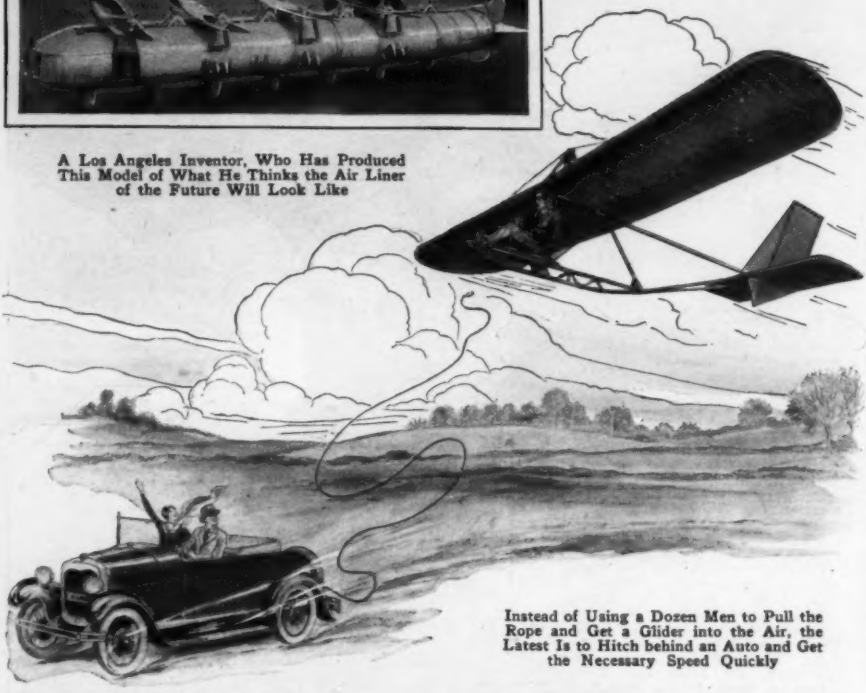


A Cleaner Developed by a Navy Officer; It Extracts Dust, Dirt and Water from the Air Before It Reaches the Carburetor; the Air Blast from the Propeller Does the Work

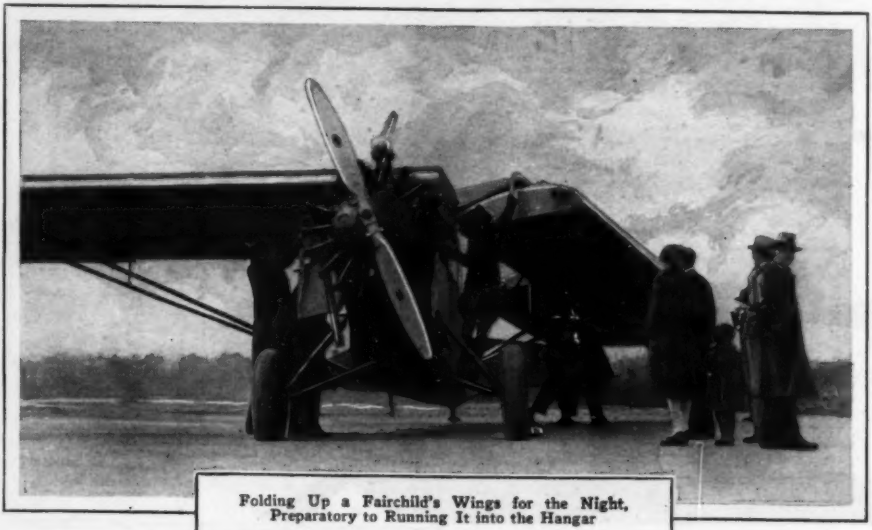
The "Sea Rover," a Small, Three-Passenger Flying Boat, Was One of the Most Interesting Exhibits at the Recent Detroit Show, For It Marked the Appearance of the First Medium-Priced Small Sport Aerial Boat in America; at the Right, Louise McPhetridge, Holder of the Altitude Record for Women, Who Recently Lost the Endurance Record When Elinor Smith Regained It; Below, Instead of Towing Targets for Anti-Aircraft Gunners, the Army Has Developed a Small Glider, Which Is Released from the Top Wing of a Powered Plane



A Los Angeles Inventor, Who Has Produced This Model of What He Thinks the Air Liner of the Future Will Look Like



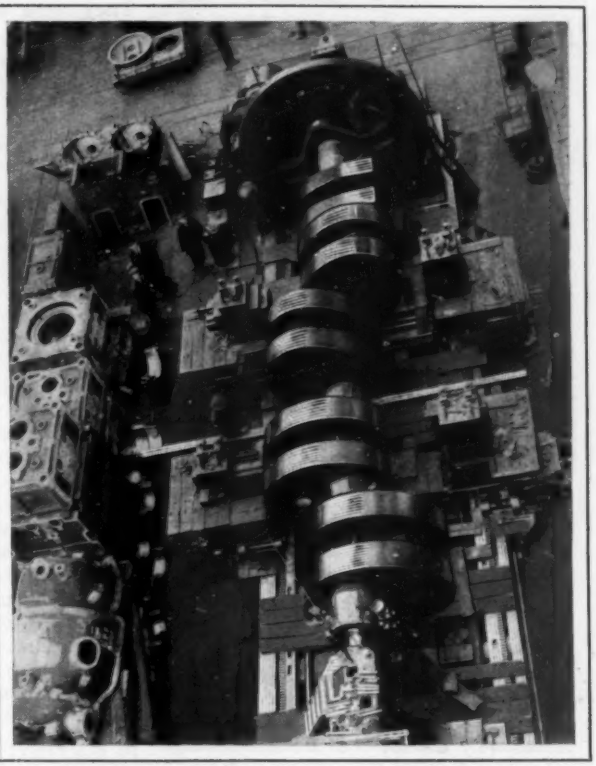
Instead of Using a Dozen Men to Pull the Rope and Get a Glider into the Air, the Latest Is to Hitch behind an Auto and Get the Necessary Speed Quickly



Folding Up a Fairchild's Wings for the Night, Preparatory to Running It into the Hangar

PINWHEEL MOTORS ARE MOUNTED ON WING TIPS

British engineers are experimenting with a different type of "gyroplane," a flying craft intended to make nearly vertical ascents or descents for landing or taking off in restricted space. This one has motors mounted on the tips of the revolving wings, thus providing a direct drive for the rotating members. Other ships of this type have had no independent means of propulsion for the revolving wings. According to the inventor, failure of one or more of the wing motors would not stop the rotation of the wing blades, and, if all the wing engines did stop, the plane could continue its journey under the power of the motor in the fuselage. Should the main engine fail, the machine could be tilted slightly forward and the rotating wings employed for propulsion and lift although at less speed. The experimental plane has four wings, each fitted with a motor, and is known as a "helicogyre."



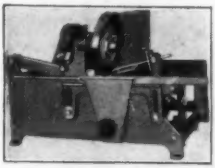
Just a Detail of a Monster Ocean Liner, Part of the Huge Crankshaft for the White Star Motorship "Britannic"

HUGE CRANKSHAFT SHOWS SIZE OF BIG OCEAN LINER

New standards in size for Britain's motor vessels have been established by the White Star liner "Britannic," recently launched. It has a gross tonnage of 27,000, and its huge bulk is evident from the accompanying photograph.

AUTOMATIC SAW GRINDER FILES SEVENTY TEETH A MINUTE

For resharpening high-speed hacksaw blades and metal-cutting bandsaws, an automatic grinder has a speed of seventy teeth a minute. A special feature is the double feed-pawl fingers which insure correct feeding of the saw even if a tooth is broken. The grinding wheel is adjustable, so that any desired hook can be ground on the teeth.



INVISIBLE RAYS GUARD RELICS IN PRIZED COLLECTION

Invisible rays have been employed to guard a famous collection of historical relics placed on exhibition in England. The beams are directed upon selenium cells which operate alarm signals. Should anyone approach too near the relic cases, and thus interrupt the invisible rays, the alarm gongs would sound automatically.

Model of Improved Workers' Helmet, through Which Water-Washed, Dustfree Air Is Supplied

HELMET WITH WASHED AIR PROTECTS WORKER

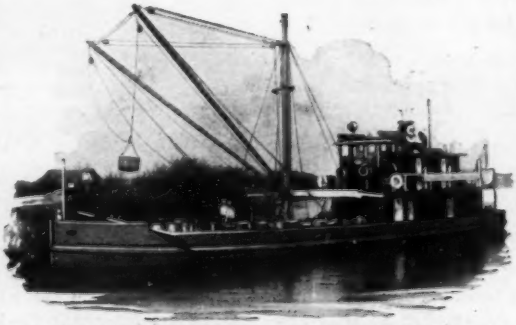
Water-washed air is supplied to a special helmet recently introduced for the foundryman, and other workers exposed to dusty, dangerous atmospheres. It rests entirely on the shoulders, relieving the head of weight; the volume and pressure of the air are controlled by the wearer, and a wool-lined neckpiece makes the helmet comfortable and dust-tight.

RATS FIND WAY OUT OF MAZE BY SOUND OF FEET

One of the secrets of the animal world that long has perplexed scientists appears to be on the way to solution as a result of experiments at the University of Michigan, where interesting tests for some time have been performed with rats. They were first placed in a maze and checked as to the time it took them to learn their way out. Trials of this sort have shown that the animals have an uncanny way of finding the exits, often displaying greater ability in this than human beings, subjected to the same conditions in a maze especially built for them. Tests by Dr. John F. Shepard, at the university, indicated that the sense of hearing played an important part in the ability of the rats to find their way out of the maze. When soundproof floors were introduced into the maze, the rats were unable to learn the way out, according to reports of the experiments, and were perplexed when squares of linoleum, placed on the floor, were moved about from one position to another. Evidently, the investigators concluded, the sense of hearing was necessary to the rats in making their escape. The sound of their footsteps apparently gave them a clue as to their whereabouts. Tests are now under way to determine if the animals depend solely upon this sense. The examination is considered especially interesting, since rats have been used widely in studying certain problems that relate to the behavior of human beings and their mental processes.

FLOATING OIL STATION SERVES CALIFORNIA FARMERS

Farmers in the delta country of northern California, where narrow rivers, sloughs and tributaries have cut the land into many islands, are supplied with fuel for their tractors, oil for their lamps and other commodities from a floating service station. It is a special tanker, 100 feet long, that carries 22,000 gallons of gasoline or kerosene, and quantities of grease in barrels and cans. Pumps are provided for filling the drums on deck for delivery or for supplying the farmers' tanks in bulk, if desired.



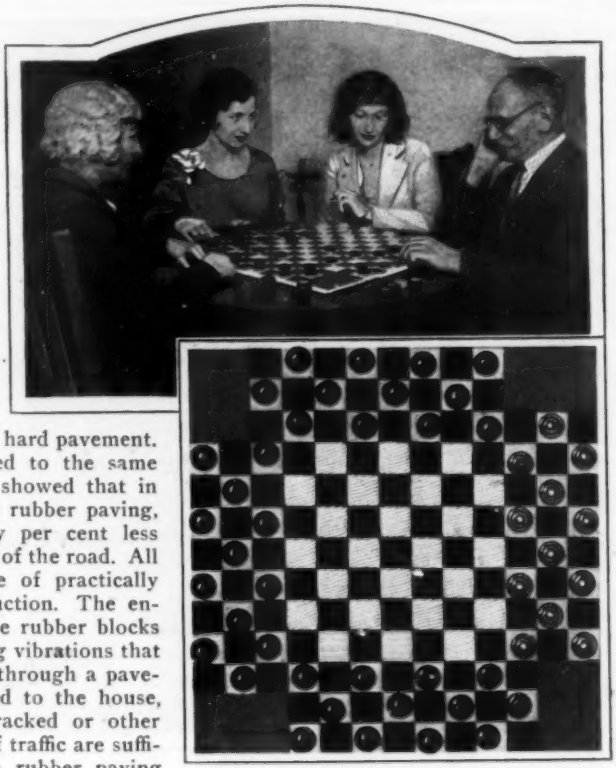
Unloading Oil from Floating Service Station, Which Supplies Farmers in California Islands

RUBBER PAVINGS EASE JARS IN BUILDINGS

Interesting tests to show the effectiveness of rubber pavements in decreasing the shocks and jars in buildings that face roadways where traffic is heavy, have just been completed in London. Measurements were made to determine the vibrations in buildings along a part of a pavement that was covered with rubber blocks and in other buildings that faced a stretch of hard pavement. Both areas were subjected to the same traffic. The instruments showed that in the buildings close to the rubber paving, the vibrations were forty per cent less than they were on the rest of the road. All the buildings tested were of practically the same kind of construction. The engineers concluded that the rubber blocks were effective in absorbing vibrations that normally are transmitted through a pavement into the ground and to the house, where plaster may be cracked or other damage done if the jars of traffic are sufficiently heavy. Although rubber paving has a comparatively high first cost, it is durable, the early experiments with it indicating that it might last as long as forty years when properly installed. The first cost was nearly $20 a square yard.

ADJUSTING AUTO BRAKES EASIER WITH PEDAL CONTROL

To hold the auto brake pedal down while making brake adjustments, a simple lever apparatus has been placed on the market. It is braced against the front seat, with the other end against the pedal. Simply by pressing down on a handle, the desired position may be reached and held.

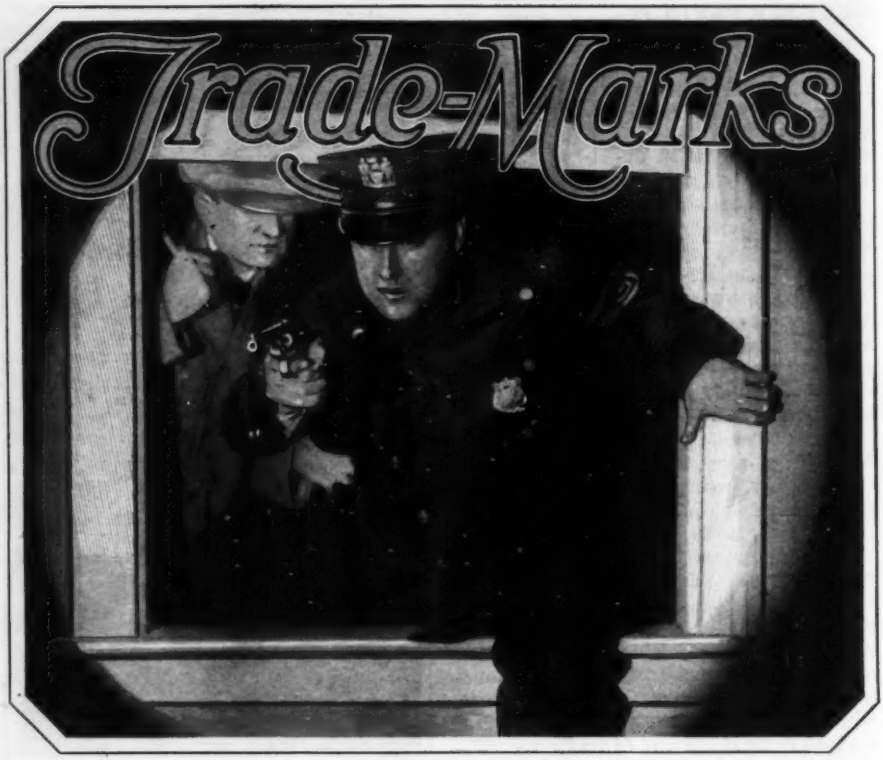


Playing the Four-Handed Checker Game, and View of the Board with Its Extra Squares

FOUR-HANDED CHECKER GAME TAXES PLAYERS' SKILL

Played on a board with 128 squares and with forty-eight checkers instead of twenty-four, a four-handed game triples the excitement and complications, for the men may be jumped from three sides. Additional amusement may be had by playing in teams, two to a side. The game was developed by Howard Wood, a World War veteran. When playing singly, each participant has three opponents.

¶The Popular Mechanics Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described and any other details in our possession, will be promptly furnished by addressing the bureau.



By H. H. DUNN

THE OLD young man, picked up in the well-known, first-page "dragnet" thrown out by the police department of a western city, smiled at the chief of detectives.

"You'll have to let me go, chief," he said. "You've got nothin' on me—and you know it."

The officer passed over a small bundle of bills, a cigaret case, matches, and other personal belongings taken from the boy when he was arrested. The youth flipped open the case, offered a cigaret to the chief and took one himself. Then he worried a match into flame by drawing it sharply across the top of the desk.

"Hello, 'Smacker'; guess you'll have to stay."

The head of the identification bureau, leaning against the closed door of the chief's room, spoke. "When you do that next time"—he pointed at the black trail of the match across the desk—"you will be doing it on a steel table, up yonder."

Dragged to the fingerprint laboratory, it was found that the marks of the young man's hands were not on file; he never had been printed, because he never had left fingerprints on any of his "jobs"—yet, by the striking of that match, fourteen house robberies were "tied" to him. Some of them he confessed, and today he is well started on a twenty-year sentence in a California penitentiary. But for the new method of identifying criminals, connecting them with their crimes, and presenting such evidence that, in many instances, they confess, this young "second-story man" would have walked out of the police station, free to continue his career of crime.

In the more than 125,000 identification cards in the police department of this city, was the description of a series of burglaries

# of Crime

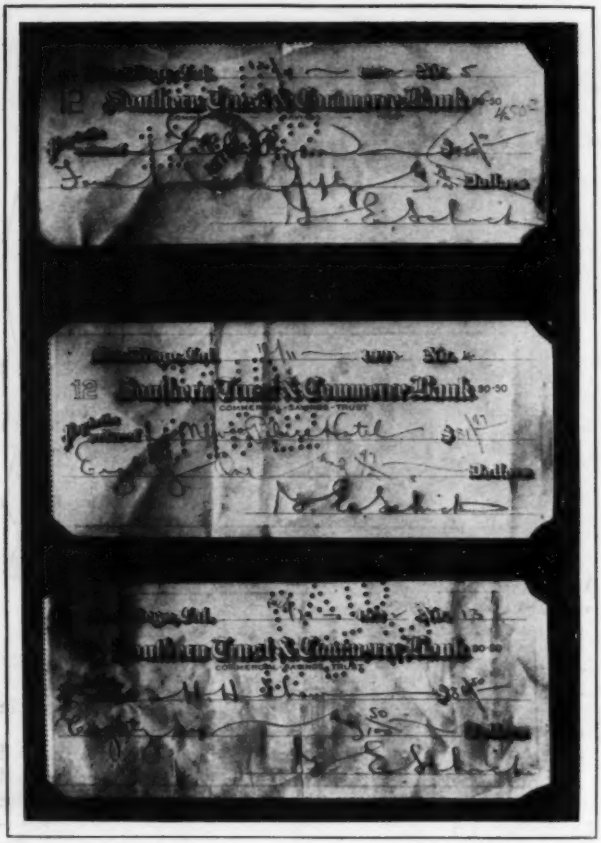
Examining a Fired Bullet through a Powerful Microscope in an Effort to Identify Its "Autograph," the Markings Caused by the Gun

by an unidentified man who invariably scratched a match on the polished surface of some one or more pieces of furniture in the house he robbed. He never had been arrested. His Bertillon measurements were unknown. His fingerprints were unrecorded. In other words, there was no personal description of him, yet he had operated from New York to San Francisco and from Minneapolis to St. Louis. This was the first time he had been arrested, and the individual "trade-mark" he had left on every crime sent him to the penitentiary, without the aid of any of the other factors on which the law has depended for so long in the identification of criminals and the connecting of men with their crimes.

This new method of establishing the identity of the perpetrator of a crime is based on the fact that every criminal, whether a "first" or a "habitual," leaves his mark on every job. He may eliminate the danger of fingerprints by wearing gloves, by painting his fingers with rubber compositions, or even by cutting down the ridges with sandpaper He may wear shoes of varying sizes and different makes and shapes, removing the menace of uniform footprints. He may be bearded in his first "mugging" and clean-shaven in the next. Some older crooks have been able to "get by" with the operation of "face lifting"; others have worn gold caps on their teeth in one robbery, leaving them off in the next; indeed, there are more than a score of tricks tried to evade identification by the camera.

But the criminal has not yet appeared who does not leave some little personal touch to his crime. With some, as in the case of the match-striker—which is true—it is a bit of unsuppressed vandalism. In others, it is an uncontrolled appetite, such as that of the Rochester, N. Y., burglar who searched ice boxes, taking nothing but cheese. At his first meal after arrest, this suspect ate the cheese offered before touching the other food. From the perpetrator of the "perfect murder," that is to say, the killing in which there is no intimation of the killer, to the crudest sneak thief, every criminal leaves his trade-mark. It is now the objective of police departments all over the world to establish completely indexed files in which may be found the methods and idiosyncracies of all known criminals, and, in so far as possible, their daily habits.

With the fingerprint discounted, due to preventive methods of criminals, it is essential that the trade-mark of the crook be known, even before he is identified, or



Three Forged Checks Made by a "Tracer"; His Method Was to Trace the Real Signature with a Stylus and Then Ink the Markings

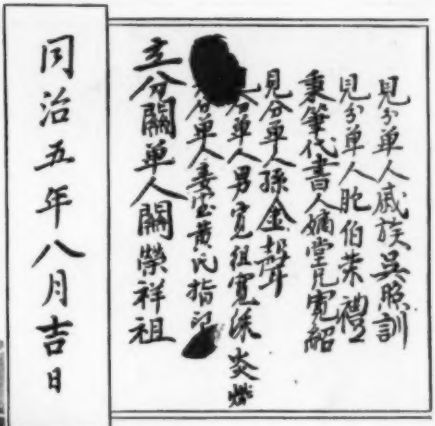
a suspect arrested. Thus, the bank robber may be down in such an index as "X," his name unknown to the police; his description unrecorded. But every suspect brought in will be subjected to study from the point of view of methods. There is, for example, one crook—known as "the party burglar"—at large on the Pacific coast. He never has been seen or described, far from being arrested, but his methods are well known, and when he is caught, he will be confronted by some fourteen unsolved burglaries. His method is to enter the back door of a residence by means of a small, split steel tube pressed into the keyhole and around the end of the key, which is then turned in the lock by common pliers. Handled with gloves, these pliers tell no tale to the fingerprint expert and may be thrown away after each job.

Once in the house, if met by a servant, this man poses as a delivery boy. To carry out this disguise, he wears an apron and carries a basket containing a number of small packages. His car is a small truck which passes unnoticed. He selects for his operations, day or night, houses in which parties are going on downstairs, and one of his victims, by the way, was the chief of detectives in the police department of a large western city, from whose home he obtained about $700 in one evening. This man takes nothing but money, proceeding to the upstairs room in which the cloaks and wraps of the women guests have been left, and seldom, if ever, entering the men's room, since men, for the most part, carry their money in trousers pockets. He wears gloves when in this room and, with an organized mind which could win him success in other more reputable lines, replaces each garment exactly as he found it. If caught in the room, he shoots his way out, and the men he leaves behind him are dead, not wounded. He is the only American criminal known to the police who uses these methods, and he probably will not be taken alive.

In the state identification bureau at Sacramento, Calif., there are approximately 400,000 cards, describing in detail the methods—known technically as "modus operandi"—of probably five times this number of crimes, the perpetrators of which are still alive, either "on the loose" or "in stir," respectively, free or serving sentences. Death alone can remove a

man's or a woman's name from this list. Even a life sentence to the penitentiary means nothing to the identification experts of the police departments of the various states. In the other state capitals are similar lists, most of them smaller, because this method of "spotting" criminals and identifying them by their trade-marks originated in California, and is moving eastward.

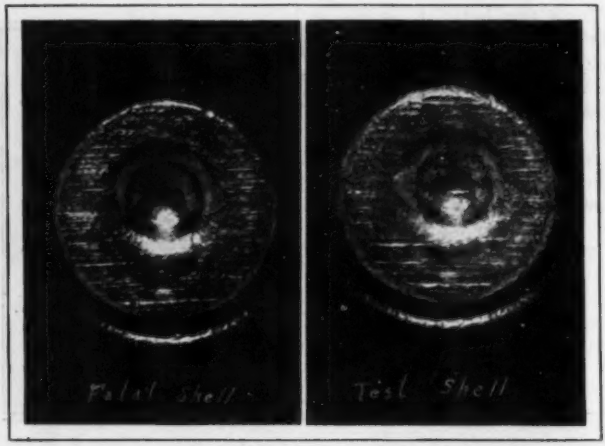
The cards in this index are about six and one-half by eight inches in size, and are cross-indexed several ways—by name of criminal, if known; Bertillon description; character of crime; individual traits of man or woman in the commission of the crime; and location (city) of previous crimes committed in the same manner. The card also contains a general personal description of the criminal, where and when first arrested and disposition of that charge, with present whereabouts of suspect, such personal habits as are known, names of close companions, especially women; and, if arrested and tried again, the disposition of that case. In other words, the crime is made to confess the criminal, rather than the suspect confessing the crime. It has been found that juries are more impressed by the detailed description of crimes believed to have been committed by the suspect on trial than they are by the usual indefinite identification of the accused by men or women who may have seen him, even in the perpetration of the crime.



Oldest Known Fingerprint on Chinese Will, and a Safe Blowing That Revealed Cracksman's Identity

Leaving a "Trade-Mark" with Pliers on a Small Steel Tube Used to Open Doors; This Man Scorned "Jimmies" and Bars

As soon as a crime is committed in any city or town in California, complete details of the job are sent to the central identification bureau in Sacramento. The method of operation is there compared with the records of thousands of other crimes, and the names of the suspect or suspects attached, copies being sent immediately to all the police departments in every state using this trade-mark system, with such other information regarding the suspects as may be available. As soon as a suspect is arrested, full results of the investigation, with complete identification



Photographs That Led to the Confession of a Murder; the Test Shell on the Right Had Markings Identical with Those on the Fatal Shell

of the man, are broadcast similarly. If he is placed on trial, the result of such court proceeding likewise is sent to all police departments.

There is a burglar, a gunman and a general "bad mug" whose hobby is clocks, and whose specialty in crime is homes whose occupants are out for the night, the week end or vacation. Owing to the fact that this man never attacks an occupied house, he never had been arrested up to the end of 1928. It had been noted, however, that, in a series of nearly thirty robberies of such houses, silverware only had been stolen, and that from each house at least one ornamental clock had disappeared. No fingerprints were left, and from two days to three months elapsed between the estimated date of the commission of each robbery and its report to the police.

The robber, working westward from a start in Philadelphia, finally reached a small city in California, where he robbed a home, during the owner's absence, of silverware worth, at "fence" rates, about $1,000. Two detectives, inspecting the pawnshops in that city, found a man disposing of unmarked silver to one of the pawnbrokers. The robbery had not been reported; in fact, there was no report of the theft of such an amount of silver. The suspect, questioned, produced several recent copies of the local newspaper, in which appeared his advertisement, offering the silver for sale. He claimed the plate as his own; told the detectives where he lived, and "played honest" so cleverly that, instead of arresting him, they went with him to his home.

There they found a young woman, introduced as his wife, in a small well-furnished cottage. But in this cottage, scattered through the five rooms, were more than a dozen small and valuable clocks. The man was "dropped," and the detectives went back to headquarters, where search revealed no report of the theft of such an amount of silver. But the head of the identification and report bureau heard about the clocks, looked in his index of more than 100,000 crimes, and found the reports of the "silver specialist" with the timepiece hobby. The cottage was surrounded, the suspect opened fire, but was captured after being wounded, with the loss of one policeman and the wounding of two others. The man eventually confessed and was given a life sentence. This criminal's trade-mark was a clock and it tripped him.

The Man Who Blew This Safe Also Left His Mark; He Made a Hole at the Bottom of Outside Door

Tear Bombs Are Proving Effective in Combating the Armed Burglar; Below, a Match Scratch That Snared a Criminal

Incidentally this method of checking crime by methods, has shown that, in the states using it, the average net to the burglar—house, bank or store—is somewhat less than $30 for each job. Most decidedly, crime does not pay, even though only a very small percentage of criminals who operate against property are caught, and a still smaller proportion convicted.

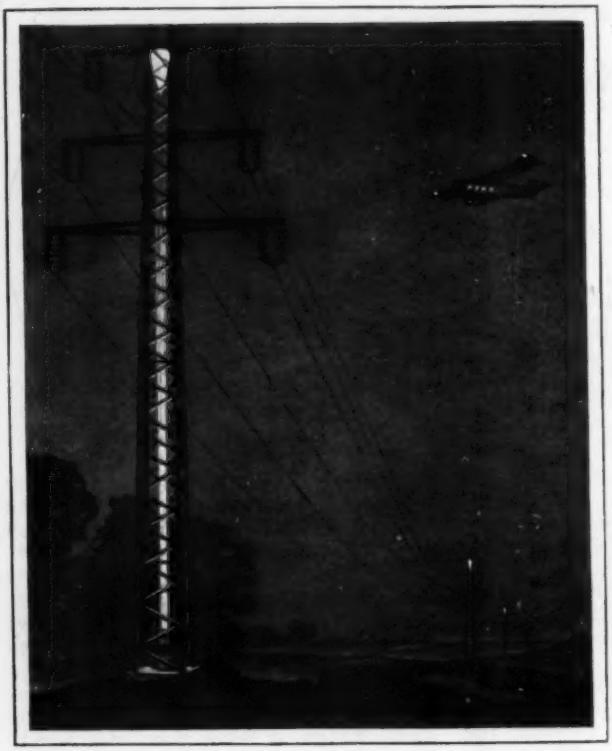
With this new method of making the crime reveal the criminal, there has been devised a machine, somewhat like a motion-picture projector, in whose magazine may be loaded pictures of 12,000 suspects or established criminals, obtained from the rogues' galleries of the world. These, with current from an ordinary electric-light socket, may be thrown life-size on the screen, so that detectives, identification experts and patrolmen may study the characteristics of wanted men at their leisure. The films are connected, and any number of rolls may be made up, or new portraits inserted at any time. An attachment, operating by groups, makes it possible to select and throw on the screen any particular picture wanted, without running through the whole roll. Description may be printed, along with character of crime and method of operation, on the picture, so that this information appears with the portrait on the screen.

Some experiments also have been made with X-rays in making identification pictures of known criminals. These enemies of society may change their faces in various ways, but they cannot change their skulls, nor can they alter fractures or peculiar bone formations in arms, legs or ribs. Extensive work along this line is being done with considerable success by Dr. G. L. Clark, of the University of Illi-

nois. The Bertillon bureau of Paris is experimenting with a method of fixing the time of commission of a crime by the rate of growth of a man's beard, which is virtually the same for all adult males. This is particularly valuable in suicides, murders and deaths from causes which probably are natural, but which may be accidental or intentional. By tracing the movements of a man for a short time prior to his death, the experts learn when he last shaved. By the growth of the beard they establish within a comparatively brief limit, the hour of his demise.

GLOWING TUBES IN POWER POLE AID NIGHT FLYERS

To make transmission-line poles visible to aviators flying at night, neon-gas tubes have been installed in some of the steel towers of a German company. A large bulb is at the top to help attract attention, and the illumination reduces the hazard of the line to the aviator besides making a pleasing effect in the dark.



Glowing Neon-Gas Tubes in Poles of German High-Power Transmission Lines Help Night Flyers Avoid Accidental Collision

SEADROME PROVES A RIDDLE; IS IT A SHIP OR AN ISLAND?

Landing fields, anchored in the sea, have presented great engineering difficulties, but these promise to fade to relatively little importance as compared with the civil and military complications which have arisen in regard to their proper classification and regulation. Are they ships or are they islands? Experts declare they are neither, yet have characteristics of both. If they are vessels, they will be subject to the navigation laws. If they are islands, intricate problems of international jurisdiction will arise. The question has come to the fore as a result of the proposed seadrome to be constructed between the United States and Bermuda. Suppose a vessel should collide with the landing field. To whom shall the owners of the ship or the seadrome turn for redress in case of damage? If a foreign power considers that such a field has been anchored too near its territorial waters and interprets it as a military threat and blows it out of the sea, to whom will that power be responsible? One question has been decided, however, and that is that prohibition laws will not be operative on the seadrome, and its designers have already provided for a bar on the landing stage. If the drome's national jurisdiction is in doubt, can criminals escape to it and enjoy immunity? If the field is considered part of United States territory, could its occupants organize as a municipality, levy taxes, possibly combine with

other seadromes of like status and seek admission to the country as a state? The idea is somewhat fantastic but, legal authorities declare, entirely possible. The most perplexing problem is the military aspect of the dromes.

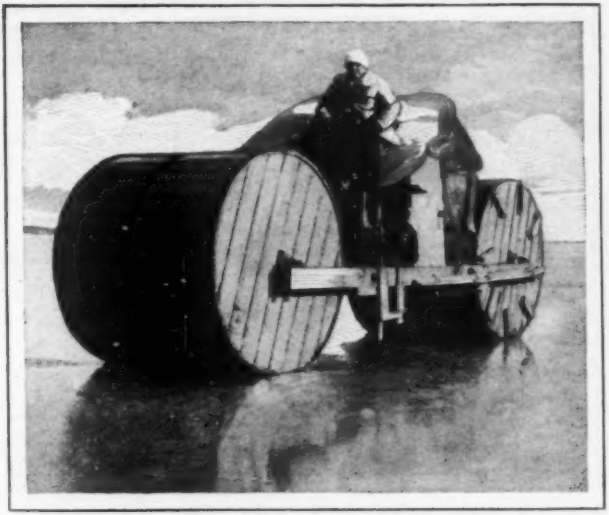
PLAN GIANT BRIDGE TO LINK SPAIN AND AFRICA

Plans for the construction of a huge bridge across the Strait of Gibraltar have been submitted to the department of public works in Madrid by a Spanish engineer. He would support it on submerged but firmly anchored floats, and equilibrium would be maintained by opposing forces, one tending to bring the floats to the surface and the other working to draw them to the bottom by strong cables. Parts of the bridge would be covered to prevent damage by the weather.

HEAT CURLER WITH HOT WATER TO PREVENT SINGEING

Better curling, without the risk of singeing or burning the hair, is said to be possible with a curling iron heated by hot water. It has a small tank into which boiling water is poured to bring the iron to the proper temperature. The curls are said to be broader and last longer with this method than with the usual curler.

Filling the Reservoir of the Curler, Which Is Warmed with Boiling Water



Rolling along in the "Ice-Mobile," Designed for Travel in the Frozen North; It Proved Superior to Sleds

"ICE-MOBILE" ON FROZEN LAKE AIDS EXPLORER

Prof. J. W. Sandstroem, Swedish scientist, who was a member of the rescue party sent to the aid of Nobile and his men, devised a huge roller vehicle for safe travel over the frozen Baltic sea last winter. The big cylinders are able to pass over rough surfaces and climb steep inclines.

GAS STORED IN OLD WELLS TO EQUALIZE SUPPLY

By storing natural gas in depleted wells, an eastern company has maintained a large supply near consuming centers without the expense of erecting special containers. The method enables the concern to accumulate, during the summer, sufficient gas to supply the needs of the winter months. According to S. W. Meals, of Pittsburgh, this system may be more widely adapted to the storage of surplus gas, in underground wells and partly depleted sands, in amounts sufficient to meet the country's maximum house-heating demands. The question of storage is one of the natural-gas industry's most perplexing problems.

It Plays for a Coin; the Radio Set Operated by Dropping Money in the Slot

COIN-IN-THE-SLOT RADIO SET SERVES HOTEL GUESTS

For a penny, two cents in American money, guests at some of the hotels in London may enjoy five minutes of radio broadcasting through a coin-in-the-slot receiver. Connected to each set and distributed in the rooms, are 300 pairs of headphones.

HOW TO ENJOY YOUR AIR RIDE RELAX AND DON'T WORRY

Helpful suggestions that will assist the inexperienced air traveler to enjoy his first and succeeding rides in a plane have been offered. An essential is to relax in your seat, settle back comfortably and not to worry. Don't become impatient if the plane does not leave the ground for a few moments, as it is necessary for the pilot to taxi to a position where he may take off into the wind. The plane is banked on a turn and, when this occurs, go with the ship; do not try to resist the motion and hold the wings down. You can't succeed in doing that and only make yourself uncomfortable. At a speed of nearly 100 miles an hour, the plane travels in a medium almost as dense as water; hence you can be assured of support from the air. To test its pressure, you can thrust your hand out of the cabin window. If the changes in air pressure affect the ears unpleasantly, the trouble may often be remedied simply by swallowing or by breathing through the mouth occasionally. This helps to equalize the pressure on both sides of the eardrum. There is seldom a sense of dizziness in looking down, and the tremendous speed at which you are traveling is not visibly apparent because of the distance from earth. By chewing peppermint gum the feeling of nausea, sometimes encountered when riding through bumpy air, can be averted.

SKIS AND SNOWSHOES IN ONE AID WINTER TRAVEL

Features of the ski and of the snowshoe have been combined in a patented article, lately introduced for the hunter, trapper or anyone who must travel over deep snow. The combination skis and snowshoes can be taken apart in the center for easy carrying, they are made of lightweight material, are narrower than the regular snowshoe and not so long as the usual ski. A special feature is that they do not have to be lifted off the snow as do the older type of snowshoe. A hinged footrest is provided and, when this is raised, the shoe moves itself forward.

Folding Snowshoes in Use, and as They Are Carried in a Neat Bundle; They Are Said to Rest the Feet

Dogs That See for the Blind

Trained Not to Cross the Street against Traffic; No Amount of Pulling Will Move This Dog So Long as the Red Light Says "Stop"; This Is Just One of the Shepherd Dog's Lessons

BY THE aid of specially trained dogs and a system developed in Switzerland, the blind no longer need hesitate in the city streets nor are they dependent upon friends or hired helpers in going about their regular business pursuits.

In Switzerland, Mrs. Harrison Eustis, an enthusiast in the breeding and training of shepherd dogs, has adapted the intelligence of this family of canine friends to the special needs of the blind. In Switzerland these dogs have learned to do many things, such as providing special help for the Swiss army in certain duties and for aid in police efforts.

The use of dogs in helping the blind is not new in the sense that they have never before been so utilized. Some dogs have been trained in individual instances. But now, using special methods, a school takes the canine pupils, and after a course that is based on the psychology of the dog and the needs of the blind, graduates are ready to work faithfully and unerringly, using their keen sense and intelligence, and actually providing, for the human being unable to see, the sense of sight.

The man unable to see, hesitant, uncertain, falteringly reaches the yard. Using his cane and tapping his way along, the gate is found. Pedestrians watch, anxious to help, but not wishing to intrude. Then the sightless one gives a whistle. The dogs that are playing in the sunlight beyond the gate listen. Then one dog—one special dog—instantly recognizes the whistle, leaves the others and bounds toward the man who has whistled. Putting his cold nose in the hand of the blind man, he thus signals that he is ready for service.

Training the Dog to Pick Up Gloves or Packages Dropped by His Owner and to Carry Them if Necessary

The man then stoops over, puts a specially designed harness on the dog. The dog waits for it to be buckled. The man lights a cigaret; then, with the strap from the harness in his hand, turns, saying "Forward," and starts off briskly down the street, confident, unafraid, the dog trotting just ahead.

Reaching a street crossing where there are traffic lights, the dog looks. If the red signal or the "stop" sign is showing, the dog sits down and the man waits, knowing by the movement of the specially designed harness that the dog is waiting for the proper moment to cross. As soon as the "go" sign is shown or the light turns to green, man and dog cross confidently, with assurance and with safety.

Reaching the office building where the man works, in which there is the usual revolving door, the dog waits for the proper moment and then pulls the man quickly forward and into the door, permitting the blind man to stand on the outside, stepping with the door and out on the opposite side. Easily and with absolute assurance, the sightless man follows the seeing eye of the canine friend.

So expertly does the dog obey the three simple commands of "Forward," "Right," "Left," that no one on the street thinks of looking. There are no embarrassing moments or offers of assistance. Not one in a thousand even recognizes that the man is blind unless he is familiar with his movements or an acquaintance.

For about fifteen years these highly trained dogs have been used in just such ways in Germany and Switzerland. It is within the last few months that the method has been adapted to America, where the dogs must learn the psychology of Americans, the differences of traffic, and a new language.

In Nashville, Tenn., Morris S. Frank is educating the great shepherd dogs for the purpose of helping the blind. Hearing about the European method, he was at first skeptical. He investigated. It seemed possible that here was a method that could be used in this country. "I decided that, if such work were really possible, I wanted such a dog for myself," Mr. Frank, who is blind, explained.

"I wrote to Mrs. Eustis to find out where I could obtain such a dog. She answered that it was true that these shepherds would do these things and that, while they could not be procured in America, she would be glad to have a dog trained for use under American conditions and train me with the dog if I could take the time to come to Switzerland for my part of the training.

"Would I go to Switzerland to regain my sight? I would and I did."

"When I came back, I was so exultant with my new-found freedom that I did not stop to fully realize its meaning. A few weeks later, however, when I came to a corner and my dog guided me across a street crowded with traffic, I heard the tapping of a blind man's cane as he stood at the curb and waited for some passing stranger to tell him if he could safely cross; there was a twinge of conscience. Such was the origin of the idea of developing 'The Seeing Eye.'"

Those interested in the welfare of the blind are co-operating in making these methods, found so useful in Europe, pos-

sible for the needs of America. These great creatures must be adapted to our traffic conditions, our laws, and the American temperament. Further, the dog must learn the language of America and be able to obey the words spoken.

"Buddy Fortunate Fields," as Mr. Frank has named his own dog, has guided him "safely through all kinds of traffic from the crowded streets of New York City to the little country roads of a Tennessee back village," according to his own words. Once the dog is trained, there is no further worry for the blind man.

The German shepherd is especially adapted to this sort of personal service, says Mr. Frank. In the first place, it has the requisite intelligence and what might be called the "will to service," developed through scores of years of work for man in tending flocks and herds, in the intricate and exacting duties of police dog, as factory, museum and railroad guard, in the various services connected with war work and as courier, Red Cross, liaison and listening-post dog.

Then, too, the shepherd is the right size and weight for a blind leader. The messages which the dog transmits to his master in this service are of a tactical sort. The dog wears a leather harness with a rather stiff, short loop, which is held in the man's left hand. At intersections, curbs and steps, the dog sits down, and for complete success it must be an animal of sufficient weight to have this act instantly transmitted to the palm of the man who is being led.

Finally, according to Mr. Frank, the shepherd dog has the requisite attributes of character. He is courageous, dependable, unswervingly loyal. The assertion that the shepherd has wolf blood in its veins is absolutely without foundation. He is the descendant, without admixture and bred up in bodily form and mental ability only by selection, of one of the oldest breeds on the European continent.

Center and Bottom, Mr. Morris Frank with His Trained Dog, and, Top, E. S. Humphrey, an Inspector, Training a Dog in Traffic

A Portable Four-Cycle Inboard Motor for Small Boats Weighs But 100 Pounds

INBOARD MOTOR IS PORTABLE AND EASILY INSTALLED

Weighing but 100 pounds, a portable four-cycle inboard motor has been placed on the market to transform your boat into a serviceable cruiser, or for interchangeable use on several boats just as outboard motors are employed. The engine is conveniently carried by a handle and can be removed simply by taking out four thumbscrews. The intake and exhaust connections through flexible hose are so arranged as to enable instant disconnection. According to the manufacturers, the engine is easily started and handled, runs smoothly and quietly, and consumes little gasoline and oil. It is suitable for use in boats from twelve feet in length up.

¶There are nearly sixty landing fields for airplanes in Alaska.

PLANTS AND SHRUBS OF DESERT NOW GUARDED BY LAW

To protect desert holly, Joshua trees and other growths of the deserts, California and Nevada recently have passed laws making it a misdemeanor to dig up, destroy or pick the flowers of some varieties of plants that grow in the dry places. Between Tonopah and Las Vegas, in southern Nevada, a wide expanse of desert country, several hundred miles long, is called the west's largest and most beautiful natural flower garden. In April and May, in years when spring rains are normal, this stretch of country is a mass of flowers of all shapes and hues.

CHEMICAL HAS SCENT OF MUSK LIKE NATURAL PRODUCT

Artificial musks, that sell as high as $275 per ounce, are being manufactured in the chemists' laboratories. Samples of the synthetic scents were passed around at a recent meeting of scientists, and even experts in perfumes were unable to detect the difference between some of the chemical products and the natural musk. The success of the chemist in this direction may prevent the extinction of the musk deer which are now being killed at the rate of 50,000 or 100,000 a year in the mountains of Tibet and western China. Musks are also found in plants, but their chemical composition differs from that of animal musk.

INFLATED PADS ON ELBOWS AID SWIMMING PUPILS

Inflated Elbow Pads Keep the Novice Afloat While He Practices Leg Strokes in Learning to Swim

To help keep the body afloat while learning to swim, an English instructor has devised inflated pads which are strapped to the elbows. They do not interfere with the arm motions and are especially helpful in practicing leg strokes, since the wearer does not worry about sink-

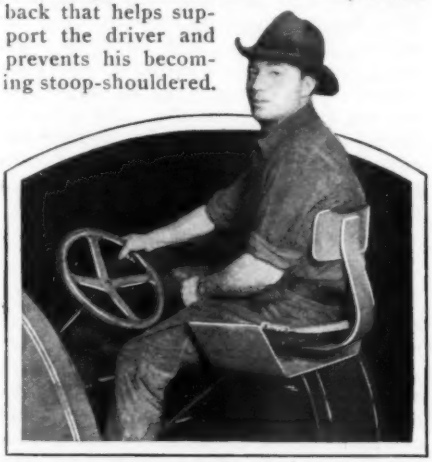
ing so long as the pads remain inflated. They are easily attached or removed and can be carried in small space.

TONS OF FISH IN DESERT LAKE SUPPORT BIG INDUSTRY

Walker Lake, a large body of semi-fresh water not far from Hawthorne, Nev., is the source of tons of fish shipped daily to Los Angeles. The lake is alive with carp, which are seined and sold to Japanese and Chinese residents of the coast cities. Under provision of the fishing permits, trout of all varieties must be released from the seines and put back. The carp range from seven or eight inches to three feet in length. Steelhead trout, weighing over thirty pounds, have been caught by sportsmen. It is believed that these fish will increase when the carp are removed. The government is to provide boating and bathing facilities for the troops and employes to be stationed at the huge munitions depot near Hawthorne.

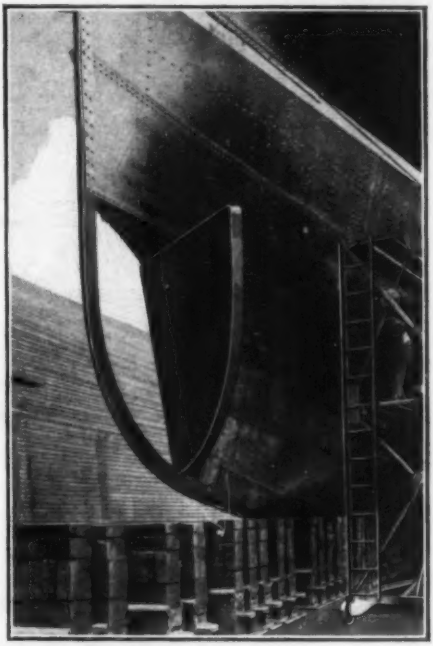
SUSPENSION-SPRING FARM SEAT HAS FORM-FITTING BACK

For all ridden farm implements, an improved seat, suspended on strong but flexible springs, has been introduced to prevent unnecessary fatigue. It is said to absorb ninety per cent of the vibrations, is entirely of steel, and has an adjustable back that helps support the driver and prevents his becoming stoop-shouldered.



Spring-Mounted Seat with Office-Chair Back to Make Riding on Farm Implements Less Uncomfortable

RUDDER IN BIG SHIP'S BOW FACILITATES STEERING

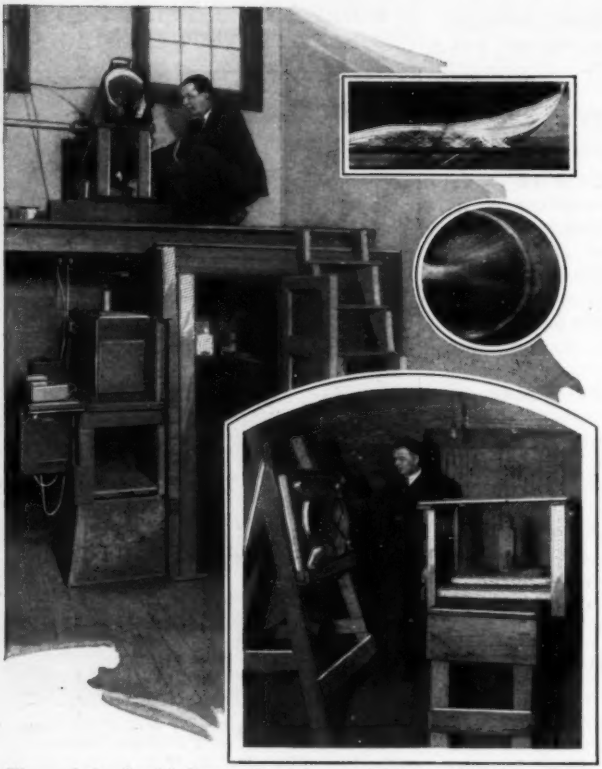


For Easier Handling in Narrow Waters, This Steamer Has Been Fitted with This Bow Rudder

So that it may be more easily steered among the narrows between Vancouver island and the main land, a large steamer has been equipped with a rudder in the bow. It is of an improved type and recently passed a successful trial on the vessel's first trip.

FLOODLIGHT IN MOVING COLORS ADDS TO NIGHT DISPLAY

One of the most unusual floodlighting installations in the country illuminates a Buffalo building in constantly moving colors. This is accomplished by an automatic dimmer arrangement and the use of red and green color screens on some of the fifty-two 100-watt reflectors that make up the battery of lights. A complete cycle, ranging from a soft red glow to a clear white light, is directed upon the building every two and one-fourth minutes, and all that is necessary by way of manual operation is to throw a switch.



Views of the Special Camera Apparatus, and Photographs of Air Waves Induced by an Explosion during Tests

PHOTOGRAPHS OF THE INVISIBLE HELP IMPROVE EXPLOSIVES

Photographing the invisible is the interesting task of investigators at the Pittsburgh experiment station of the bureau of mines, where research is in progress with a view to producing safer explosives for use in mines. The pictures, taken with a special motion camera, show the air waves that speed with tremendous velocity immediately after an explosion. Normally, these air "shock waves" are invisible, but they are made luminous and so registered on the film by means of an ingenious optical arrangement. Light from a carbon arc is focused on a stainless-steel mirror, a glass mirror being impractical because it would not withstand the force of the explosions. From this steel mirror, a beam of light passes through the region where the pressure waves are to appear, thence through the lens of a special wave-speed camera and strikes the film, which is moved at a rate of more than 100 yards a second. The pressure waves are made visible owing to the fact that they refract the light differently from still air.

POTATOES FED COW FAIL TO TAINT MILK

That the potato flavor sometimes detected in cream is not caused by feeding the cows potatoes, is one of the interesting conclusions recently announced by the North Dakota agricultural college. The flavor comes, not from feeding the cows, but from exposing the cream to air heavy with potato odor, as in basements or other storerooms. Once the cream has acquired the flavor, it could not be removed by any ordinary treatment, such as pasteurization, Prof. J. R. Dice, head of the dairy department of the college, found. As feed for milk cows, raw potatoes compare favorably with corn silage, it was announced, although they are not quite so palatable. The potatoes should be sliced or crushed to prevent the cows from choking upon them. Potato sprouts should not be fed, as they contain a poisonous substance.

DUSTLESS COAL

By the application of certain chemicals, coal is being made dustless not only at the time of delivery but it remains so after storage in the bins. The chemicals are sprayed on in solution and penetrate the surface of the coal, eliminating the dust and reducing the air-slacking surface. The substances also absorb and hold the moisture.

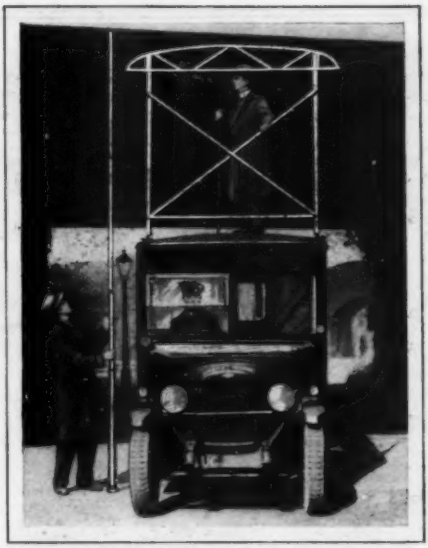
CAMERA THAT WEIGHS A TON TO PICTURE LIGHT

Scientists are about to take another step into the invisible world with the aid of a huge camera weighing nearly a ton and made largely of brass. The instrument is under construction at Princeton University and is to be used in exploring the mysteries of light, measuring the wavelengths along the ultraviolet end of the spectrum, from the last one that is visible, down to zero. At this zero point, the vibrations known as light merge into those that compose the radioactive and X-rays. Evidence is already at hand showing that all these rays, including the vibrations of heat, electricity and radio, are related, as they all apparently are manifestations of the same force, although vibrating at different rates. The camera has been designed to record the spectrum of light on a photographic plate which is sensitive to rays invisible to the eye. By analyzing these lines, the wavelengths may be determined. The camera will house as complete a vacuum as it is possible to attain and, in this space, will be an automatic spectroscopic laboratory.

TRICYCLE RUN BY BATTERIES HAS THREE SPEEDS

Operated by electric batteries, a tricycle has three forward speeds and one reverse with foot control. It develops from eighteen to twenty-five miles per hour, and is said to run 125 miles on one charging. For invalids and others, it is especially serviceable because of its ease of control and low operating costs.

Two Passengers Ride Comfortably in the Electrically Operated Three-Speed Tricycle



Measuring the Clearance under Auto Bus, Which Has Extension "Rule" on Top for Quick Gauging

AUTO USED AS RULER TO GAUGE HEIGHT OF BRIDGES

To measure the height of bridges and viaducts under which busses on a London line must pass, a special auto has been equipped to simplify the task. It has a collapsible framework or gauge on the top. By raising this and by making other measurements, investigators can quickly determine if there is sufficient clearance for the busses to travel in safety under the bridges and viaducts.

"BOTTLED" WORDS TO CURE TELEPHONE ECHOES

By delaying speech transmission, actually bottling up a word on the telephone wire and holding it for an instant, engineers have demonstrated a way of overcoming echoes and otherwise improving telephone service. The holding lasts only for a few hundredths of a second and is accomplished by means of retarding apparatus similar to that already employed in telephoning over transatlantic and long land cables.

¶ Last summer, 2,000 airplanes were operated as 'taxis" in the United States.

The Circus Clings to

By EARL CHAPIN MAY

FOR the past twenty centuries the public has patronized circuses. Though some circuses are larger or smaller than others, they all look much alike. Fact is, they haven't changed at all so far as the attractions offered are concerned.

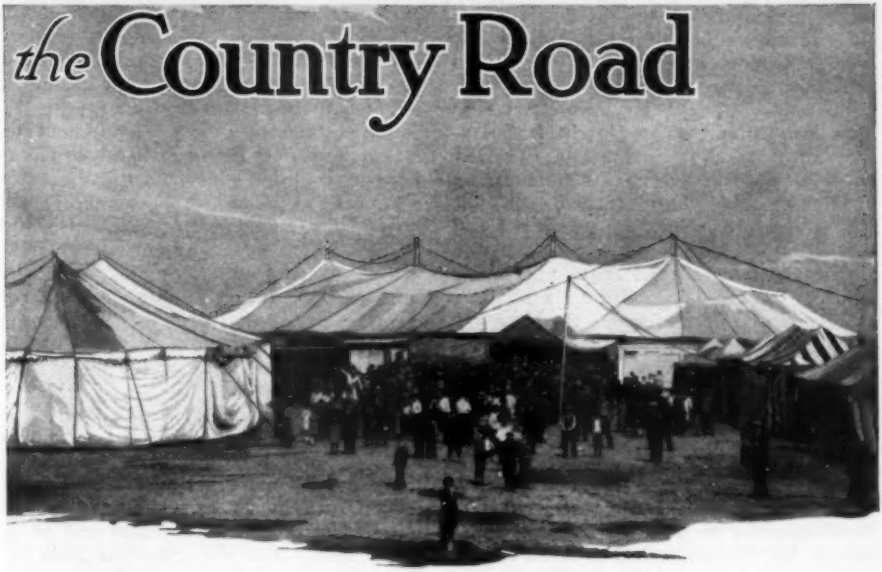
American circus managers imported elephants, giraffes and hippopotami away back before the Civil war. Zebras, lions, tigers, camels and ostriches were featured under the big white tents before Barnum left storekeeping for the circus business. Trapeze, contortion, acrobatic and riding acts do not differ materially from their eighteenth century predecessors. The only developments discernible are in structural and mechanical engineering and in the methods used for "getting the circus over the road."

Tents must be gotten up and down, usually six times a week for thirty weeks. By employing various pulleys, blocks and falls, such as are used on sailing ships, the circusmen can raise enormous canvases and lower them with a minimum of man and horse power. By designing jacks, stringers and planks, they have been able to seat large audiences in knock-down grandstands, which are made safe by toe pins and iron chains.

Within the past twenty years, they have learned to spread and raise their canvases by gas-engine power, with endless-tread and heavier trucks. They have driven hickory stakes into tough ground with small motor-powered pile drivers instead of the old human-powered "sledge gang." In other ways, they have taken much of the burden from man and horse in erecting and tearing down their canvas cities. But none of these improvements solved the pressing problem of transporting tons of property from town to town.

In Europe and other foreign countries,

the Country Road



circuses remain a month or more at each "stand." In America the daily movement of a circus is traditional. During the average tenting season of thirty weeks, each circus must move to a new market one hundred and eighty times. That is the only way it can sell its wares. Hence the transportation of a circus is the owner's most pressing problem. Circus transportation has gone through three stages on this continent.

Your father can remember vividly the thrill given him some warm morning when he discovered an elephant's track in the country road. He knew, from seeing gaudy circus bills, that Van Amburgh's circus and menagerie was going to play the near-by town. He knew that, like all circuses, Van Amburgh's was a "wagon show," traveling across the country in wagons pulled by horses, while the elephant furnished its own motive power.

Up to fifty years ago, nearly all circuses thus traversed their chosen territory. Van Amburgh's was not the only wagon show. John Robinson hauled his circus from town to town with horses. So did Barnum in his early days, and Adam Forepaugh and the Sells Brothers. That's how the Ringling Brothers got their start.

Theirs were "mud shows" in circus vernacular, because in wet weather they were "in the mud" and many a tired trouper of the fifties to eighties got off a heavy wagon in the dead of night to help push or pull a big load out of a rut, if the elephants were not handy. When the bedraggled caravan arrived at its daily destination about 10:00 a. m., it paused outside the rural metropolis to "clean up" at some wayside stream, put plumes on the horses' heads, red coats on band and performing folk, and thus "make a parade" to the town's "show grounds." That was the beginning of an old circus day.

The afternoon and night performances over, all hands joined in tearing down the tents. At midnight, the baggage train got under way. Performers, musicians and executives went to a hotel, while the baggage train and animals creaked, groaned and struggled along dark roads. Fence rails or bundles of hay, laid crosswise of highways at forks and turns, kept the caravan on the proper route. At daylight, the performers, musicians and executives followed the caravan in carryalls, stages or other carriages. An average of thirty miles a day was a maximum when a good road was a great rarity.

As circuses increased in magnitude, they found they must "make" the larger towns in order to exhibit profitably. Railroads were becoming more numerous. So, in 1856, Spaulding & Rogers' circus "took to the rails" out of their winter quarters in southern Illinois. The Haight & Chambers show tried it next; then the Dan Castello circus traveled 20,000 miles, by rail, in a single tenting season. But it was tough going for those first railroad shows.

The standard railroad gauge was in the future. Gauges ranged from six to three feet in different states, so there was a great deal of heavy, laborious and delaying transferring. In spite of variations in gauges, P. T. Barnum put his World's Fair circus on the rails. But he did it unwillingly. His manager and general director, W. C. Coup, had a hard time "selling" Barnum on the railroad-show idea. All during the 1872 tenting season, Barnum objected to the innovation vigorously. Mr. Coup also had to teach wagon showmen the art of railroading.

During that year the railroad loading and unloading "runs" were originated. These are the wooden and steel inclined planes down which the heavy wagons are lowered by tackle and snubbing ropes after the circus train is "spotted" in the railroad yards. Years later the French artillery saw these runs, during the Barnum & Bailey European tour—and promptly adopted them for the French army.

With standard railroad equipment on standard roads, the great American circus became greater—it became too great for practical purposes. As an example, I can recall when Ringling Brothers drove into Rochelle, Ill., one spring morning in 1889, after covering twenty-eight miles by horsepower from Byron in one night. Today, the Ringling Brothers and Barnum & Bailey combined shows travel on ninety all-steel cars, each of which is seventy feet in length.

With the increasing magnitude of the greater shows, the matter of obtaining suitable "lots" or circus grounds is becoming annually more serious. Cities have grown with motor cars. Workmen live miles from factories and come and go in motor cars. The old commons have become residential districts. I have known big circuses to exhibit six miles from a city's center. This involves long hauls of heavy wagons, made possible only by motor trucks.

Gov. Andrew Downie and Two of His Company at Their Living Car, an Automobile Completely Equipped as a Home for Use on Tours

Versatility as Well as Specialization Are Characteristics of the Circus Performer, and Here Is a Troupe That Well Illustrates the Fact

These same motor cars have worked another basic change in the circus business. They have introduced the motorized tented show. Good roads resulted from more automobiles and trucks. In a way, that made wagon showing easier. Hence Ernest Haag kept his caravan moving annually out of Marianna, Fla., up to the Canadian line and back again and laughed at railroads profitably. The Orton family continued to leave their farms at Adel, Iowa, each spring and "mud-show" it through the central west until fall frosts drove them back into winter quarters. A dozen other small shows clung to the ever-improving country road. Then the country road, like its city sister, became all cluttered up with motor cars. Even night hauling did not help the circus teams. Trucks and belated cars got in the way of the percherons.

Impressed by the omnipresence of the new gas buggies, a veteran of the mud-show days, named William Newton or "Lucky Bill," left his winter quarters at Quenemo, Kans., in the early spring with all his circus goods and chattels on heavy trucks. He was the pioneer motorized-circus man. The trucks were so heavy they bogged down on soft roads and lots. Lucky Bill was lucky to get out alive. He went back to horses and wagons thankfully. But his son, "Honest Bill," saw what was wrong. He put his circus on one-ton trucks and augmented that motive power with touring cars. He has thus toured across the southwestern deserts into northern California.

More than two dozen bona-fide circuses, with performers, bands, elephants, lions, tigers and everything, now are touring the country. Ernest Haag, showman for thirty years, continued to haul his show by horse power—and to walk his elephants, "Alice" and "Tip," northward and southward across the country six and seven thousand miles a season. But within the past two years, he has become largely motorized. The M. L. Clark show, another veteran of mud, sand, clay and dust, has gone from horses to gasoline motive power.

Every state in this country, every province in Canada will be visited by motorized circuses this year. Most of these shows will pattern their transportation equipment and methods after those adopted by Andrew Downie. This year the Downie show travels on eighty trucks and light cars, principally in eastern territory. Although it is billed as a "Wild Animal Circus," it is circus, menagerie, and everything, including a resounding, eye-filling street parade with four bands bursting simultaneously into melody. It is the equivalent of a circus hauled on

fifteen seventy-foot steel cars. To haul such a railroad show this year, when railroads are cold toward circus business and avoid every "special" movement possible, would cost, on the average, $500 daily. Mr. Downie puts most of that $500 in his pocket, because his trucks are his ever-ready railroad train.

But that is not the only way the motorized circus gains by deserting the rails for modern country roads. One of the banes of a railroad showman's life is the haul between railroad yards and show grounds. This takes time and, sometimes, money. Cities often charge for damage caused by heavy circus wagons to their streets. Railroad circus wagons must be heavy, because each railroad charges so much per mile per railroad car. Hence each car must be loaded to capacity. The motorized circus, moved on light trucks, seldom carries more than two tons per load.

When the motorized circus reaches its next town over hard highways for which there is no charge, it proceeds directly to its lot, unloads, sets up—and takes in the money. When it is through on that day's stand, it tears down, loads up and awaits the morning.

Most of the workmen sleep in wagons or small lot tents. Most of the better-salaried people keep house in little homes on wheels, with berths, carpets, lavatories, clothes presses—neat as a pin and comfortable. When morning comes they are away.

You couldn't get these modern gypsies into stuffy Pullman cars, to sleep two in a berth and two berths high, because room is at a premium on circus trains. On most motorized circuses, ring stock, such as riding horses and trained ponies, are carried in trucks. So are the elephants, trained dogs, tigers and monkeys. When the parade goes forth with blaring bands, the horses, dogs and elephants are led. The rest of the parade is motorized.

The best feature of the new system of getting a circus over the road is that which sends the cookhouse or dining tent ahead of the show. Each day's schedule, on all circuses, calls for breakfast at eight o'clock, dinner at noon and supper at 4:30 p. m., right after the matinee. In case the railroad circus arrives in town late, breakfast may not be served until 10:00 a. m. With the old mud show it might not be ready until noon—and often wasn't.

But circuses of the Downie type send their cookhouse trucks to the next town as soon as supper has been served. The crew sets up kitchen ranges, dining tents and tables before the crew turns in to sleep. When the circus gets into town next morning breakfast is ready—"the cookhouse flag is up" in circus vernacular.

As an illustration of the flexibility of the latest type of circus, Dorsey Brothers,

Between Horse Power and Motor Power Comes Elephant Power, and in the Circus, the Latter Is Often the Most Dependable and Available

from Chicago, have played northern New York State territory in August and have been "pitching on the lots" in Kentucky during the middle of September.

Practically every old-time mud show is now relying partly or wholly on motor trucks for transportation. The circus clings to the country road, but is becoming motorized.

MAP ON WAREHOUSE TO COST FIFTY THOUSAND

A map of California, 115 feet long and forty feet wide, is to be painted on the wall of a large warehouse and storage building in Los Angeles. The task will take nearly three years, it is expected, and will cost approximately $50,000. Seats will be provided in a parking space near by so that persons can study the map at their leisure. It will be illuminated at night.

RAZOR BLADE USED AS SCRAPER IN ADJUSTABLE HOLDER

Old safety razor-blades may be adapted for scraping glass, cutting, ripping and other purposes by inserting them in an adjustable holder now on the market. The chief feature of this unit is that the head, where the blade is fastened, may be turned to different angles. No screws are required to fix the blade and no tools are needed. A sliding clasp, or sleeve, on the handle of the holder tightens the head, and when the blade is not in use, it may be reversed to a safety position for carrying in the pocket, simply by turning the head of the holder around, until the edge of the blade is against the grip.

Ocean cables to the value of over $1,000,000,000 have been laid under the seas.

Beauty Aid and "Detective" Combined; the Adjustable Mirror on Its Extension Support in Auto

MAKE-UP MIRROR ON AUTO DASH HELPS DETECT POLICEMEN

Attached to the automobile dash or other convenient place at the front of the car, a small mirror, mounted on a collapsing extension arm, is useful in aiding the woman driver or passenger in her make-up and also reveals cars or other vehicles that may be approaching from the rear. Hollywood drivers who have tested it, declare that it helps them see the motorcycle policeman before he arrives.

BIG RADIO SETS FOR DIRIGIBLES TO HAVE LONG RANGE

Radio apparatus which will have a communication range of more than 8,000 miles is being designed for the navy dirigibles "ZR-4" and "ZR-5," now under construction at Akron, Ohio. The distance is the approximate cruising radius of the big airships, and the equipment will be far more powerful than that now installed on the "Los Angeles," which will be used for experimental purposes in determining just what sort of radio sets the new ships will need. The dirigibles will have eight engines instead of five, and the ignition system will be specially shielded to improve radio reception on board. The ships will have 6,500,000-cubic-foot capacity and will cost approximately $5,000,000 each.

AIR-LINE TICKET OFFICE SPEEDS PLANE TRAVEL

Scene at Chicago's Air-Passenger-Bureau Office, Where Flying Tickets May Be Purchased over Any Licensed Passenger Air Line in the World

"Do you furnish flying clothes or must I buy them myself?"

"There are no parachutes in the planes, you say? Well, why haven't you?"

"I want to get to Winnipeg in a hurry. What is the best air service you can give me. Do you have a plane to Crookston?"

Just a few sample questions, typical of the scores of queries addressed to busy agents at Chicago's consolidated air ticket office, the first of its kind to be established in the United States, where you can purchase transportation over any licensed passenger air line operating in any part of the world. The office serves directly the six passenger lines operating out of Chicago, sells passage for sight-seeing trips over the city and is the central clearing house for the branch offices.

Who travels by airplane these days? The public, of course, and a visit to this interesting spot where the cadence of transportation is keyed up to the swift rush of big tri-motored planes, is a convincing demonstration that air ways are now an accepted part of ordinary business life, and flying, with all its romance and thrills, is fast being absorbed into the routine of everyday existence.

There's the ticket for instance. It looks almost the same as an ordinary railroad slip, although a bit shorter and simpler. The passenger wants to make air connections at Kansas City for an early morning arrival at Houston, Tex. Agent Leeds M. Chesshir reaches behind the counter and consults an official airway guide, giving the time of arrival and departure of all passenger planes on every line in the United States. The office has been oper-

ating but a few months, yet fifty tickets a day is an average sale for the flying season, not counting the sight-seeing trips.

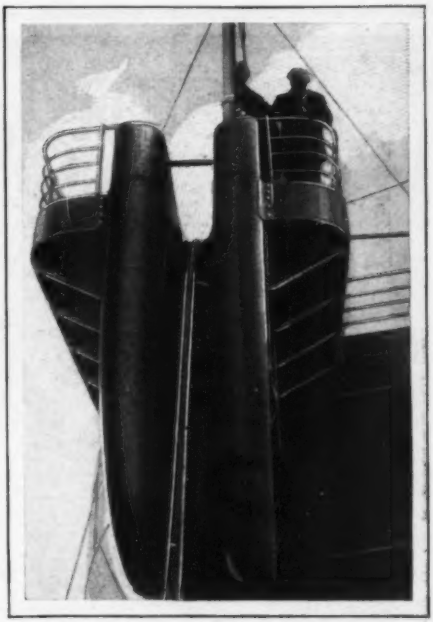
"All sorts of people travel by plane and all ages," said Mr. Chesshir. "We have them from nine months old up to seventy years. Of course, the bulk of the business is done with men who have important engagements in distant cities and find the faster travel by air an economy, although the tariff is higher. A surprising number of women are flying and they are just as casual as the men and just as businesslike.

"We have fewer questions about flying togs and parachutes all the time and scarcely anyone arrives with extra baggage. They all travel light and are dressed as they would be for a rail journey, for the modern passenger plane, of course, is a cabin affair, and people are rapidly realizing that special togs and parachutes are not necessary."

LIGHT WITHOUT SHADOW HELPS MICROSCOPE WORKER

To illuminate the field under the microscope, a special lamp that casts no shadow has been introduced. The reflecting surfaces are ellipses, so arranged that they throw the light into every corner and recess of the area under the lenses.

Lamp in Use under the Microscope; Opening in the Shade Affords a Clear View through the Lenses



Reel in Ship for Paying Out Cable That Now Links Sweden and Finland

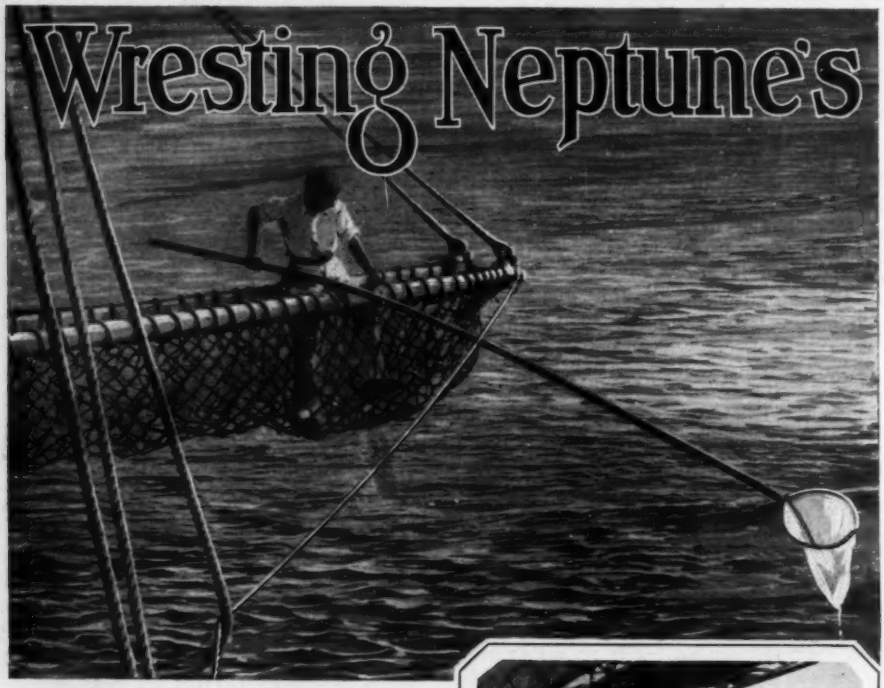
SWEDEN-FINLAND CABLE TAKES NINE MESSAGES AT ONCE

Nine communications can be carried on at the same time through the cable between Sweden and Finland, recently laid and connected after five months of difficult work. In places, the line lies 780 feet below the surface and it had to be threaded through a series of intricate passages among a group of islands that called for expert navigation on the part of the crew managing the cable ship, from which the wire was payed out over a special reel.

PLANTS SET OUT IN MOSS POTS SHOW BETTER GROWTH

Peat, pressed into squares and formed into pots with a hole for earth and the seed to be propagated, have been found useful in planting. The pot and the plant are set out without disturbing the roots which easily pierce the walls. There is less likelihood of the growth wilting, it is said, and the peat moss, of which the pot is made, finally disintegrates, adding valuable organic matter to the soil.

Wresting Neptune's

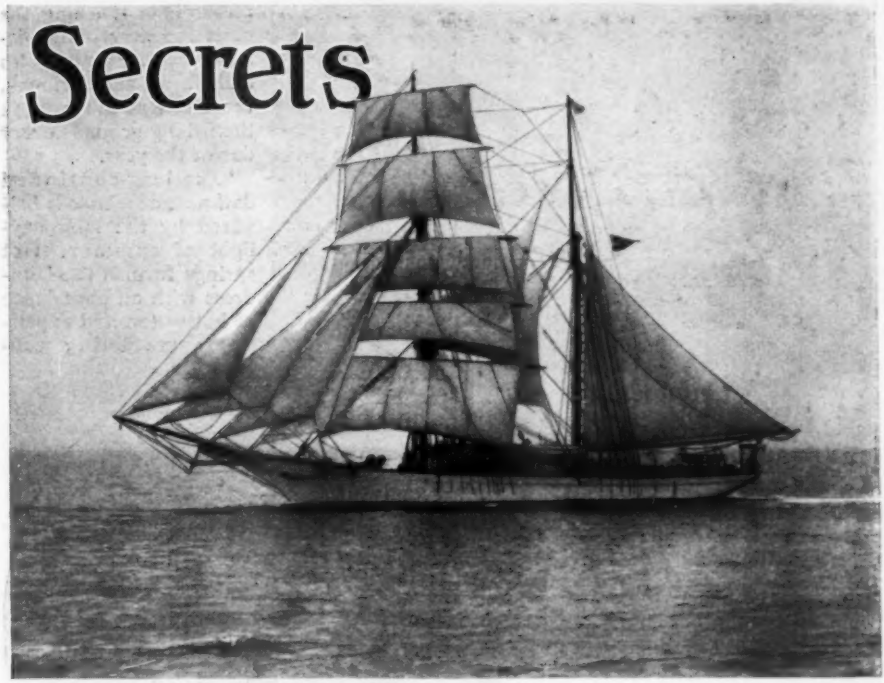


Using a Dip Net from the Boom Walk on the "Carnegie," and One of the Deep-Sea Water Bottles

By C. MORAN

MEASURING the depth of the sea, the causes of arctic and tropical storms, the temperature and salinity of ocean waters, the occurrence of submerged mountains in uncharted regions, and securing a volume of other data of practical value to maritime commerce, a group of world-famous scientists who are exploring all the oceans of the world on a 110,000-mile three-years cruise in the non-magnetic ship "Carnegie" have completed the first leg of the voyage—that encircling the north Atlantic.

"We have been learning many things about the sea," reports Capt. J. P. Ault of the "Carnegie." "Our observations have told us how much the compass has changed over these routes since our previous cruises in 1910, 1913, and 1915. We have secured new data relating to the electricity in the air and the quantity of



The Non-Magnetic Ship "Carnegie" under Full Sail; There Is Barely a Ton of Steel and Iron in the Entire Vessel, Giving the Minimum of Magnetic Interference

dust to be found at sea. The water bottles used to measure the temperature of the sea at various levels come up on the wire from the ocean bottom ice-cold, and the thermometers give the temperature as two to three degrees above freezing with the surface at forty-four to eighty-two degrees Fahrenheit, depending upon location."

The "Carnegie" was built in 1909. As the vessel was designed for the making of magnetic surveys, it was constructed almost entirely of non-magnetic materials, there being in the entire vessel only slightly more than a ton of iron, steel, and other magnetic metals. More than this quantity might seriously affect the delicately poised compass needle and the sensitive instruments with which the vessel is equipped and which are used in the investigations.

These investigations, on the present cruise, deal with variations in the compass needle because of geographical position, electric conditions of the air over the oceans, ocean circulation, the conformation and topography of ocean basins, the nature of bottom sediments, water temperature and salinity at various depths, deep-sea life, and the distribution of plankton, the fundamental food supply of the fishes.

"Occasionally the bottles on the wire, lowered for samples of water at various depths," Captain Ault says, "fail to reverse and thus to function. Sometimes we find that an unfortunate animal of the deep has fouled the wire, thereby preventing the small brass messenger from slipping down and tipping the bottles and thermometers which register the temperatures at stated intervals. Again, at times, the wind causes the vessel to drift so rapidly that the wire is thrown too far out of its vertical position to permit the messenger to slide down readily.

"The depth of the sea is measured every

poppies, and over all the atmosphere of fishing, the chief industry of the island. Despite winter gales and storms and darkness, the trawlers are out on the fishing grounds every day of the year.

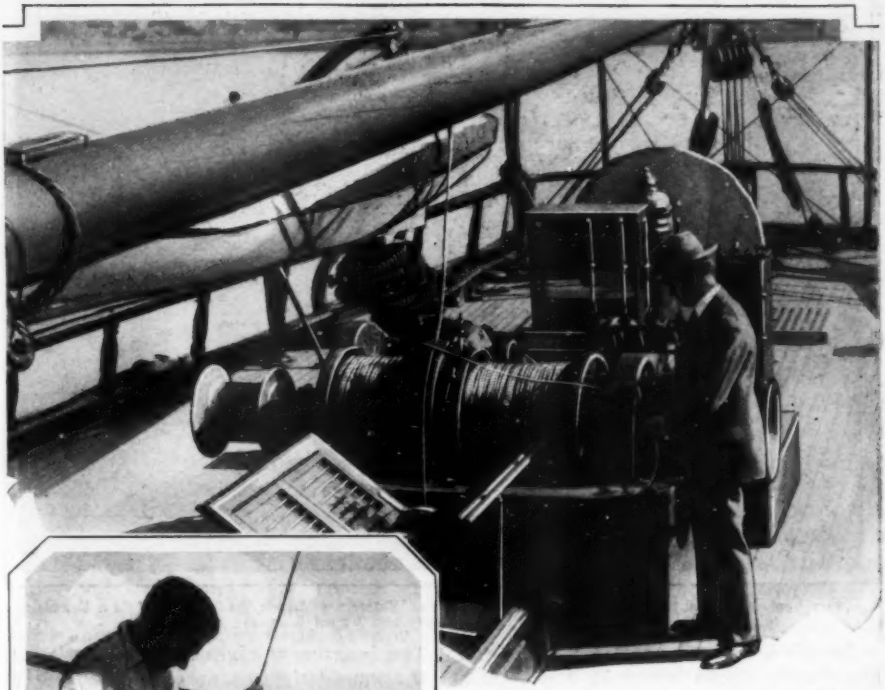
"The long-continued darkness of winter is balanced by the long daylight of summer. Hot springs furnish the laundress with an abundance of hot water, and experiments are being conducted to utilize this subterranean heat for commercial purposes and for heating houses. Northern lights played around us on several nights, and on August 5 we passed close to an iceberg, 400 feet long and ninety-five feet high, which furnished

The Anchors, Top, Are of Bronze, and the Steering Wheel of Wood, to Avoid Magnetic Interference with the Ship's Work

few hours by the echo method. Many new deeps and peaks have been discovered and much information has been added to our knowledge of the shape of the ocean bottom in regions where soundings have not heretofore been taken. On our trip across, we had to tack back and forth ten days before we could enter the English channel, and run the engine against a wind which seemed to be nailed down to the east point of the compass.

"We came into Reykjavik, Iceland, on July 20, in the midst of rain squalls and low-hanging mist and fog. Owing to strong currents and local magnetic disturbances, rendering the compass almost useless, we were well up into the Havnafjord bay before we became aware of our position, which we were able to determine only when the mist lifted with the rising sun.

"It is difficult to describe the weirdness of continual daylight, of sighting a new country, having small farms, green meadows, beautiful and enormous pansies and



Captain Ault Inspecting the Non-Magnetic Electric Winch, Which Handles 20,000 Feet of Wire, and, Below, a Plankton Pump

a thrill to those who had never before seen one.

"We have a plankton pump so constructed that it can be lowered, say to 100 meters, and a brass messenger sent down the wire to release a catch which controls the operation of the pump. The power is supplied by a thirty-pound weight on the end of 100 meters of wire on a reel on the pump, the wire actuating the gear wheel.

"Attached to the pump is a small silk net through which about 150 liters of water are strained. When all the wire has run out, the pump is closed off and we then haul it to the surface. Thus a sample of the organisms to be found at the 100-meter level is obtained without contamination with material between that level and the surface.

"Our meteorological observer is kept busy looking after the automatic instruments, besides carrying out some solar-radiation and evaporation observations. We have also made some use of the new 'boom walk,' two thirty-foot booms with net between, extending out from the ship's side. These enable the observer to walk out over the water and use the dip net and tow nets outside the disturbance caused by the wash of the ship."

Diving Apparatus Used to Study Sea Life in the Shallower Waters near Land; the "Carnegie" Is a Complete Floating Laboratory for Many and Varied Sciences

As this is written, the "Carnegie" is in the Pacific ocean where it will remain throughout the current calendar year. During the first portion of the cruise, that in the north Atlantic, the magnetic declination, or compass variation, was determined at 135 stations, and the inclination, or horizontal force, at forty-nine stations, thereby adding much valuable information to our knowledge of the changes over the north Atlantic ocean. Observations of electrical conditions in the atmosphere were made daily.

Three hundred and thirty determinations of the depth of the sea have been made with the sonic depth finder. This is an electrical apparatus designed to measure the depth of ocean floors by recording the time required for sound waves to reach the bottom and be reflected back to the surface.

BIRDS FLY FASTER THAN PLANES CAMERA SHOWS

Swallows fly three times faster than the best pursuit planes in the French army, a "machine-gun" motion-picture camera, developed by three Paris scientists, shows. The instrument gives simultaneously, on the same strip of film, clear images of a guiding mark on the ground six feet from the lens, of an airplane flying far away and of a man placed 150 feet away. By comparative tests, so recorded, the superior speed of the birds was proved.

BALANCER FOR AUTO WHEELS ELIMINATES "SHIMMY"

For balancing auto wheels to stop the tendency to "shimmy" at high speeds, a simplified outfit has just been introduced. It consists of a heavy shaft with two tapered cones and fittings to hold the wheel balanced on two special ball bearings, housed in a seamless tubing. Small lugs are then added to the lighter portion of the wheel simply by fastening them to the rim lug bolts until it is brought to perfect balance.

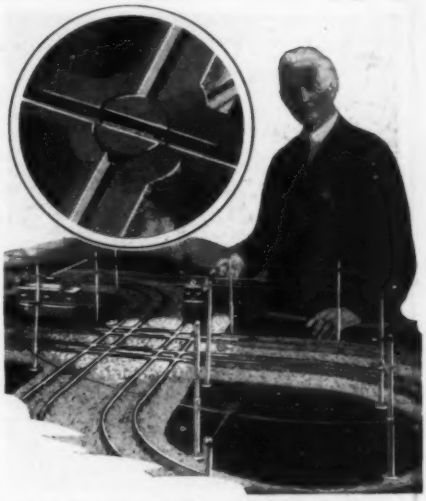
FUEL-AND-OIL SIGNAL WARNS WHEN TANKS ARE LOW

Bull's-eye signals installed on the instrument board, warn the operator of an automobile, motorboat or airplane when the tanks need gasoline and the oil pans need replenishing. A red light flashes for gasoline and a blue one for lubricant. The device is easily installed and operates simply by making an electrical connection when the contents of the containers reach a low level. The lights remain on until the tanks are filled again. The signals may also be adapted to the steam boiler, to warn when the water gets low, and to oil-heating systems.

PERSONAL TALKING-MACHINE RECORDS AS SOUVENIRS

Studios where you can step in and make your own phonograph records or have the voices of your friends and loved ones recorded, are now being established in several large cities. The records are quickly made, played for you before you leave and will last indefinitely. The idea is not entirely new, but has reached a degree of perfection unknown before the application of the microphone and improved recording apparatus. The records are valued not only as gifts and souvenirs but have practical use for teachers and performers in studying the voice.

Recording Outfit, Making a Record, and Samples of the Product Ready for Playing



Inventor with Model of the Turning Block at Rail Joints, Designed to Eliminate Jars

RAILS CROSS WITHOUT BUMPS BY TURNING BLOCK

To eliminate the jars and bumps that usually occur when trains pass over intersecting rails, a western inventor has introduced a device that virtually makes a continuous rail at the crossing point. The unit is simply a cylindrical block, grooved in one direction only and placed at the intersection of the rails. At the approach of a train, it is turned mechanically to allow the wheels to roll through.

RADIUM SHIPPED BY AIRPLANE TO SAVE INTEREST

Air transportation is effecting economies in various ways, and one of the most interesting to come to the attention of the National Air Transport, is in the matter of radium shipments. Lead containers of the substance are rushed to all parts of the United States from Chicago in response to orders from physicians. A package weighs only about twenty ounces, and the delivery time is cut to a minimum, thus helping the patient and cutting down the interest on the large amount of money represented by the precious radium. The material is but one of the many thousands of commodities now being sent by air mail and express.

Reconditioning Golf Balls on the Links with the Aid of the Motor or Water-Driven Cleaner

GOLF-BALL CLEANER ON COURSE HELPS IMPROVE GAME

For cleaning and whitening golf balls, a unit operated by electricity or water power has been introduced for permanent installation on the course, where it is accessible to all players. Pressure on a pedal starts the cleaner working, and from one to six balls may be cleaned at one time. They come out white and shining, easier to find on the fairway and better for playing. The outfit withstands the weather, is easily installed and is safe and simple to operate.

RICH DEPOSIT OF RARE ORE FOUND IN NEVADA

What is declared to be the only known commercial deposit of brucite, a rare mineral that can be used where other magnesium compounds are now employed, has been discovered and opened to some extent near Luning, Nevada. A prospector accidentally stumbled across the ore and at first had no idea as to its character or its value. He had samples analyzed and the findings were that the deposit may yield a fortune for the discoverer. Two bodies of the ore, geologists believe, merge into one at a depth of 200 feet or so. The deposit was covered with a layer of powdery magnesium carbonate which had been formed by the action of the weather upon the brucite. Among the many uses for magnesium are drugs, paper, explosives, fireproofing and different kinds of cement. Brucite has such a high content of magnesium that one and one-half tons of it are equal, in its magnesium character, to more than two tons of magnesite ore and the ratio is higher as compared with other known magnesium ores.

COTTON PICKER AND CLEANER REDUCES HARVEST COST

Successful use of a cotton-harvesting machine, planned to meet crop conditions in Oklahoma and western Texas, is reported. It is drawn down a row, the plants being led into a ramp and the cotton picked off by steel fingers and elevated to a hopper at the top of the machine. The process does not end there, for the trash, hulls, burs and unopened bolls are separated from the cotton and thrown back on the field where they have some value as fertilizer. According to one report, there was a very considerable saving in harvesting cotton with this outfit as compared with the cost of hand methods.

Improved Cotton Picker That Cleans the Crop, and Is Said to Reduce Harvesting Costs

Elaborate City Model in Colored Sand, Showing Principal Features of Long Beach, Calif., Including the Pier

CITY MODEL IN COLORED SAND SHOWS MANY FEATURES

Business structures, the pier, beach and other important features of Long Beach, Calif., were realistically represented in colored sand by an artist who specializes in sand sculpture as a form of diversion. Details were carefully modeled to scale, and the use of different colors produced striking effects.

HANGAR THAT REVOLVES TO AID AIRCRAFT TAKING OFF

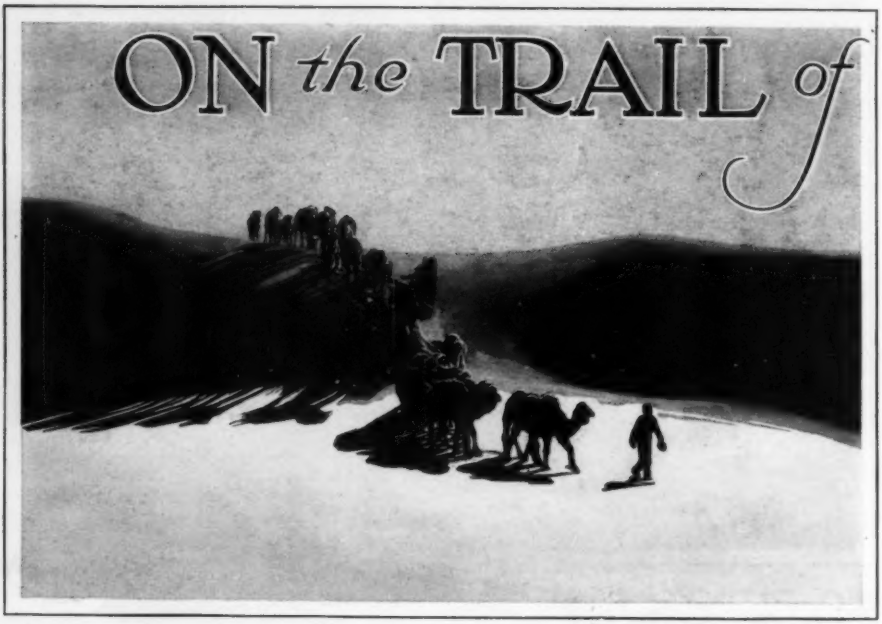
To simplify take-offs and make them safer, the German government is constructing a revolving hangar for dirigibles. The chief advantage of the plan is that the shed can be turned about to permit the easiest launching of the dirigible with regard to the direction of the wind. Other interesting ideas in hangar construction include the two-story one being built at the airdrome in Rome. Planes taxi up a 200-foot runway to the upper story, the lower being reserved for smaller planes, and for pilots' and passengers' quarters. The plan is suggested for consideration at airports in this country. According to some students of the situation, landing fields and ports are becoming so congested that the two-deck and three-deck hangar may be needed as a solution of the problem.

BANDAGES FOR SMALL CUTS QUICKLY APPLIED

For dressing small cuts, burns and other hurts, a gauze pad of the right length and fixed in the center of a strip of adhesive tape has been introduced. The bandage can be put on in a few seconds, saving time and the bother of scissors or other tools. They are furnished in a metal box and are carefully protected from being soiled.

¶One of the world's smallest fish is the Philippine "goby," which measures about a quarter of an inch in length.

ON *the* TRAIL *of*



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Asiatic Caravans, Plodding across the Shadowed Sands, Occasionally Passed the Explorers in This Ancient Land Where the Mode of Transportation Has Not Quickened for Centuries

"MONGOLIA is a land of mystery, paradox and promise; of painted deserts dancing in mirage; of untracked forests and roaring streams; of limitless plains and nameless snow-capped peaks."

Such is the description of Roy Chapman Andrews, internationally famous explorer, recently returned to America after five months spent in the great Gobi desert of Mongolia in what is regarded as a highly successful effort to prove that somewhere in Asia's remote areas was the cradle of man.

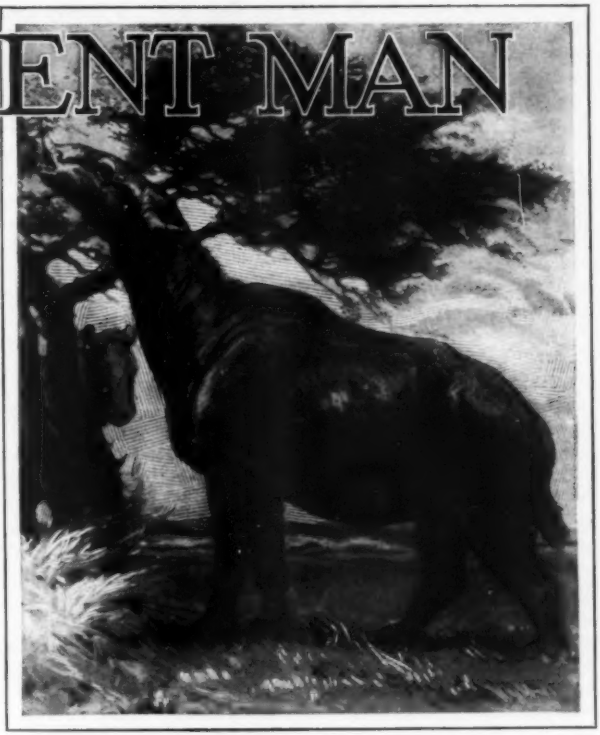
Along with him, Doctor Andrews brought thousands of feet of motion-picture film which tell a story of adventure and hardship that for sheer thrills and bravado has rarely if ever been paralleled. The amazed onlooker sees eight motor cars and 125 camels literally fighting their way through oozing mud holes, towering mountains of sand and well-nigh impenetrable rocky wastes, and through rivers several feet deep, for a total distance of some 5,000 miles, of which 3,000 were hitherto virtually unexplored.

Strange and fantastic Asiatic types, some never before seen by the white man's inquisitive eye, perform weird antics; mammoth-sized bones of animals which lived millions of years ago and had never been heard of before, are shown being dug up during hours of painstaking labor under a temperature which Doctor Andrews says averaged 140 degrees Fahrenheit; and in addition are to be seen fossil remains of prehistoric cultures being revealed by the expert methods of the Andrews party.

Probably the most inspiring point about the entire trip to the average person is that practically all these new finds, many of which will go far toward revolutionizing modern-day theories as to just where ancient man first roamed the world, were discovered only two weeks before the expedition was due to have its ending. For months the automobile-camel caravan had roamed the treacherous desert wastes. Then the party literally stumbled into the area that contained the new finds which have shed yet more fame on the explorer. Doctor Andrews says:

"During all my Mongolian trips, my un-

ANCIENT MAN



Restoration by Charles R. Knight, Showing How a Giant Beast of Antiquity Probably Looked in Life

derlying purpose always has been to find evidence, if possible, to support my long-held theory to the effect that, somewhere in Asia's remote areas, was ancient man's original cradle. I am quite certain that man must have evolved in a great plains region, since there must have been a region where he had to struggle for an existence. However, of course I am referring to a mode of life not so severe as to prevent his development, but just severe enough to stimulate him toward vigorous mental and physical effort.

"With this conviction in mind, then, I have been following the procedure, ever since 1922, of taking a research trip every year or so into the Asiatic plains. One year, I make a practice of conducting a general survey or reconnaissance of a given region and the following year I aim to examine the specific finds more thoroughly. This year's expedition was designed merely as a survey, though, of course, it turned out to be far more than that.

"A few words should be said about the general conditions in Mongolia. As to size, were we able to superimpose it on a map of the United States with its easternmost tip at Washington, D. C., the western end of Mongolia would extend beyond the Great Salt Lake and almost touch the Nevada line. It would reach as far south as Austin, Tex., and, on the north, halfway across North Dakota.

"The Gobi desert extends from west to east through the very heart of Mongolia and yet, in this vast area, there's not a single mile of railroad, a fact which has meant that transportation has been mainly by camels. Now a camel caravan moves very slowly, only about two miles an hour, and even under excellent conditions barely travels fifteen or twenty miles a day. So, a couple of years ago, I hit upon the idea, hitherto never before tried in the Gobi, of employing a combined camel-automobile-truck caravan. The autos might go on ahead under favorable circumstances and the camels transport the food and gasoline.

"To make a long story short, our latest trip was one continual process of fighting our way through 5,000 miles of territory most of which would bring nothing short of horror to the average motorist, let alone the seasoned camel driver—and we had a goodly number of those. Time and time again we had to turn back in the face of gigantic sand mountains, or else try as best we could to protect ourselves from the furious onslaught of desert wind-

storms that relentlessly lash the face and body and threaten to blow almost every movable object before them. And with just about equal frequency, all hands had to co-operate in moving our trucks through gaping mud holes, sand skyscrapers, regions filled with giant bowlders and streams of extremely doubtful depth.

"A somewhat humorous situation arose which brightened some of our more arduous moments. It seems that the Asiatic camel, faithful as he is, is rather prone, upon occasions of long journeys, to get exceedingly footsore and weary. Nor were our camels exceptions in this respect. Every now and then, a camel driver would exhibit one of his charges whose hoofs would make a mature bunion green with envy. But there was one camel driver who saved the situation. Noticing that there was a lot of wear and tear on our automobile tires, he hit upon the ingenious idea of making rubber shoes for the beasts by means of cutting up the old tires into proper lengths. The idea worked very well indeed, and afforded the white members of the party many a much needed chuckle."

How the explorers happened to stumble on their highly important finds of the hitherto unknown prehistoric beasts makes a highly absorbing story. "It so happens," Doctor Andrews says, "that J. B. Shackelford, worthy wielder of the motion-picture camera, is a man who dearly loves to go a-hunting fossils. On this particular occasion, he was browsing about one morning a couple of miles from one of our desert camps, when he saw what looked at first glance to be a giant white ball. The discovery so thrilled him that he came dashing back to camp, posthaste, to spread the news. Says Doctor Andrews:

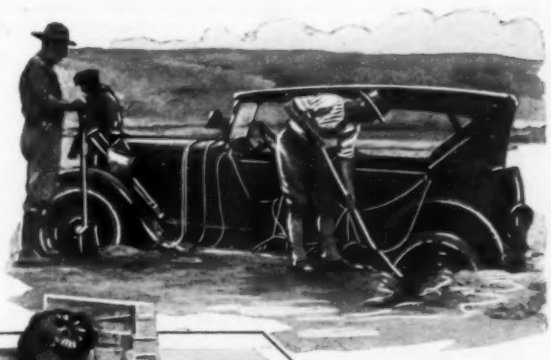
"Somewhat incredulous, we investigated and found the 'ball' on the side of a great ravine. After considerable brushing and digging, we found that it was the upper arm bone of some kind of beast that surely must be of prehistoric origin. Picture our surprise and delight when, after careful measurements, we found it to be four feet long and about as thick as the average person's chest. Here surely was something unique to modern science, so it may be taken for granted that we did considerable digging in that region from then on.

"Nor were our further efforts vain. After some fifteen feet of hillside was cut into, we saw revealed a tooth the size of an orange, some vertebræ and some sections of a massive foot. It did not take

Removing the Bones of the Mongolian Colossus, an Interesting but Delicate Task Requiring Skill and Patience; the Explorer Is at the Extreme Left

our staff long to figure out that this was the fossil remains of the largest land mammal ever found; that it was a mammoth beast, some twenty-eight feet high; and furthermore that it maneuvered about on legs about as massive as the pillars of a cathedral. No doubt it fed upon the tops of trees in the Gobi millions of years ago, long before that region became one of the greatest stretches of desert in the world. The beast has not yet been named, but it seems to belong to the group known as the Baluchitherus, or family of the great hornless rhinoceros.

"Although all the fossils found were of animal remains seemingly remote from man, they nevertheless seem to be closely tied up with the prehistoric human problem in Asia. In other words, I believe our party opened up a new chapter in the life history of central Asia. Man is a mammal. And now the ancestors of the world's great group of mammals have been found in the Mongolian desert wastes. Furthermore, in just such strata, one may well hope to find evidences of ancient man's culture."



© Roy Chapman Andrews

Digging Out of Desert Mud; "Patching" Camel's Foot with Old Tire, and Mongolian Lamas, or Priests

Doctor Andrews was asked, since he is sure Asia is man's original home, why, in his opinion, no direct evidences of prehistoric man have been brought to light there, despite the most valiant efforts of explorers and archæologists. "The reason," he explained, "is this: Human bones are exceedingly delicate, certainly far more so than are the bones of most other animals. Thus the chances of finding any such are very remote, particularly since the age-old action of rock slippages and water pressure would always tend to crumble the bones almost beyond possibility of recognition.

"Furthermore, although I found no skulls of human beings, I did find, in a remote region, hundreds upon hundreds of stone implements and artifacts belonging to a remarkably intelligent stone-age people who must have lived in Mongolia some 20,000 years ago. But the significant fact, so far as the question of man's original home is concerned, is that these

Explorer's Motor Caravan, Crossing Typical Desert Waste Land; without the "Covered Wagon" of the Twentieth Century, Such Desert Explorations Would Be Well-Nigh Impossible

'dune dwellers,' as science now refers to them, show marked points in common with the Azilian peoples of France and Spain who lived close to the end of the stone age—about 15,000 years ago.

"Here the interesting question arises: Did the dune dwellers migrate to Europe and establish the Azilian culture there? They could have brought along with them the technique of their flint industry, and adopted the use of bone implements in Europe after arriving, when stags were abundant in the heavy forests.

"In any case, here is a strong bond in common between Asia and Europe and, perhaps, when the scientists have made a close comparative study of the artifacts of the two peoples, we may learn something interesting about the relationship that will ultimately help solve our problem of where man originated."

"NOISE SPONGES" IN AIRPLANES HELP TALKERS

By lining the walls of passenger airplane cabins with "noise sponges," engineers of the bureau of standards are seeking ways to reduce the unpleasant sounds of the motor and other parts of the ship as the craft speeds through the air. In making the tests, a scale of noises audible to the human ear was arranged so that the character of the sounds produced by the plane could be determined more easily. It was found that the noise is of a mixed nature, so that the question of insulation was more difficult than would otherwise have been the case. Experiments made with a Ford tri-motor ship showed that cabin walls built up of layers of a two-inch blanket of a sound-absorbent material, fiberboard and perforated aluminum, permitted conversation in normal voice while the plane was at full speed.

POISON GUN TO KILL WEEDS SAVES HAND WORK

To kill poison ivy, burdock, dandelions, and other obnoxious weeds, a gun that forces a quantity of liquid poison close to the roots has been introduced. It saves stooping and pulling the weeds, and is light and easily operated. The liquid does not stain the hands or clothing and is non-poisonous to birds, animals and human beings.

LEARNING TO WEAR ARMOR WAS A HARD TASK

Knights and youths of old, training for military vocations, were compelled to undergo rigid practice before they could wear the heavy suits of armor with which they fought in combat. Men of today have donned the trappings of the soldier of long ago and often have had great difficulty in even keeping their balance and walking with the suits, without attempting to move about as they would in battle. Lessons in armor wearing usually started early and lasted for a few minutes at a time. When the young man developed more endurance, the wearing time was increased until he gradually became accustomed to his heavy load. Even so, warriors clad in armor frequently fell in exhaustion before meeting the enemy.

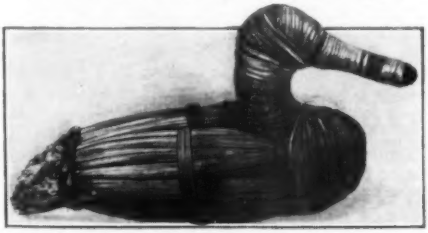
Portable Bathhouses Are Quickly Set Up or Carried, and Can Be Used on Any Beach Not Already Equipped

PORTABLE BEACH BATHHOUSE LATEST SWIMMING AID

Swimmers can carry their own bathhouses with them to beaches that are not equipped with regular facilities for dressing, as the result of an English inventor's idea. He has introduced a portable shelter in the form of a bell or barrel-shaped tent that can be folded into small space yet is large enough to permit one person to change his clothing. Only the head is exposed when the occupant is in his "house."

DECOY THIRTY CENTURIES OLD FOUND IN NEVADA CAVE

Intact and in good condition, after having lain in a Nevada cave for 3,000 years, a decoy duck fashioned from withes by Indians, has just been discovered. Besides the duck, the cave yielded fragments of baskets, spears and spear throwers, as well as cooking utensils of stone. The relics are believed to have belonged to an ancient race that were exterminated by the Piutes who used feathers on decoys.



Used by Hunters Centuries Ago; the Decoy Duck Found in Nevada Cave with Indian Relics

PLANT SUPPLIES CATTLE FOOD TEXTILES AND PAPER

Three useful purposes are served by a plant being cultivated in England. Fiber from its bark is used in the manufacture of textiles, cellulose for making paper is obtained from its core, and its seeds are manufactured into an edible cake for cattle. About eighteen months are required before the plant is ready for harvest. Many other plants produce more than one useful article. Bamboo, for instance, is widely employed for building material and its young shoots are eaten. Sugar has been manufactured from peanut shells and recently many products have been developed from cornstalks and cobs.

RAMPS AT AUTO CROSSINGS TO PREVENT ACCIDENTS

Model of the Ramp Arrangement for Auto Crossings to Speed Traffic

To prevent interference at highway crossings and eliminate the need of traffic signals, an eastern inventor has developed a special ramp system for intersections. It permits one line of traffic to cross and pass over the other, while entrance or exit to the grade level is provided through openings in the ramp at the sides.

TREE SAP AS CHECK TO RADIO HINDERS FOREST WORK

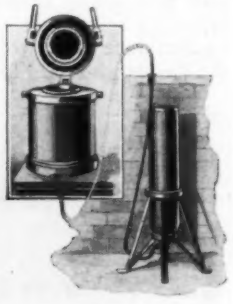
Radio will be a great aid to the forest ranger and already has been of service in spreading word of fires, and for other purposes, in forest-patrol work, but engineers have encountered a peculiar barrier to the efficiency of wireless in forest work in tree sap. In the spring, summer and fall, when the trees are full of sap, marked absorption of radio waves has been noticed. The extent has not been determined, but it has interfered with the operation of some sets, particularly the smaller ones that ordinarily would be well suited to the needs of the ranger, who must carry portable equipment of little weight. Officials of the New York State college of forestry recently declared that "it is not definitely known as yet how an effective system of radio communication can be made a practical thing under forest conditions, largely due to the mysterious barriers encountered in the woods."

SUBWAY AIR COOLS THEATERS AND OFFICE BUILDINGS

Air at a practically constant temperature of fifty-five degrees Fahrenheit, is taken from the freight subway in Chicago to cool several of the office buildings and theaters in the downtown district. It is pure and dry, and is led into the structures through special shafts. The freight tunnels extend for more than sixty miles and are used for hauling vast quantities of goods to and from terminals.

FREEZER MAKES "DRY ICE" DISKS TO PRESERVE ICE CREAM

Disks of solid carbonic-acid gas, with a temperature of 114 degrees below zero, are quickly made in the drug store, to keep ice cream from melting while it is being carried home in paper or other containers. The process is simple, the gas being admitted from a drum into a special unit which prepares the disk in less than half a minute. The valve releasing the gas, automatically closes when the disk is ready. The freezer is handsome in appearance and may be installed on the counter or any other convenient place, while the drum is hidden in the basement or other dark chamber. Tests have shown that four ounces of the frozen gas will last from four to six hours in an ordinary paper ice-cream container, so that a package could be carried a long distance without melting. The gas does not melt, it simply evaporates and, in so doing, insulates the ice cream with a cold vapor. It does not affect the flavor of the cream in any way and is harmless.



UNITED STATES LEADS NATIONS IN MAKING AIRPLANES

Aircraft production in the United States last year saw the construction of approximately 4,600 ships, a number greater than that built by any other nation, according to reports from the department of commerce. France produced 1,440 planes; Italy, 475; Germany, 300, and Switzerland, 25. Great Britain led the nations in the export of aeronautic products, the total value being nearly $7,500,000. The value of such products shipped from the United States in 1928 was $3,714,429. Canada proved the best market for planes manufactured here, sixty-two machines being sent to that country, while Peru purchased twenty-four of the ships.

CEMENT FROM OYSTER SHELLS SALVAGED FROM SEA

Quantities of cement for all kinds of building purposes are being manufactured from oyster shells dredged from the waters of San Francisco bay. The shells extend over a large area, the beds ranging from five to fifty feet deep. Two big dredges, equipped with Diesel engines which supply electricity for the pumps that suck up the shells and deliver them through fifteen-inch pipes into dredges, work from three to five miles off shore with crews of ten men each. The two dredges pump about 8,000 cubic yards of material in eight hours. The shells are taken to kilns, where about 6,000 barrels of cement are turned out every twenty-four hours.

Filling Dredge with Oyster Shells Pumped from the Bottom of San Francisco Bay for Making Cement

Illuminated Uniform for Traffic Policeman; It Helps in Giving Signals at Night

HUMAN TRAFFIC SIGNALS AID DRIVERS AT NIGHT

Successful experiments have been conducted in Washington, D. C., with lighted harness for traffic policemen on night duty. A red light is worn on the shoulder strap and a green one on the arm band, in order that the signals may be more clearly visible to drivers.

CARRIER PIGEONS ON BIG RANCH SERVE AS TELEPHONES

Because of the high cost of installing telephone lines, the owner of a large ranch, in Nevada, is training carrier pigeons to deliver messages to foremen at scattered sheep camps and other places. He has eleven birds now being taught to take messages and return with replies.

¶Some whales can remain submerged for twenty minutes.

The Final Step in Finishing a "Whirlwind" Motor; When the Mechanic, with Wrench and Mallet, Tightens the Propeller Hub-Cap Nut and Completes His Assembly Job

By MYRON M. STEARNS

THE DAY Charles Lindbergh landed in Paris behind his Wright engine, the men back in Paterson, N. J., who built the motor, paraded through the town.

No man was their leader. Peter Ihrman, foundryman; Ed. Wagner, millwright; Harry Hopp, burnisher; Udo Refi, lathe hand; Paul Landa, enameler; Frank Sweetman, inspector of valve springs; Cassimere Boll, tester; Charlie Weitz, stock chaser—each man felt that it was the perfection of his own work that had made the achievement possible. Lindbergh's engine was their engine.

"If this little rocker arm had gone wrong, it would have meant just as big a bust as if the master rod itself had broken." That was the way Tom Bornkamp, one of the men in the assembly room, put it. He was right. There is no unimportant part in an airplane motor. A tiny locknut, working loose, may be the cause of as great a catastrophe as a bad main bearing. If, while Lindbergh was boring his way through the mighty cloud ranges that challenged his skill and courage above the tossing Atlantic, any least piece of the motor that carried him forward had proved defective, he would have disappeared forever, instead of triumphantly completing his journey at Le Bourget flying field.

In the 425 pounds of a nine-cylinder "Whirlwind," there are 3,147 separate parts, running all the way from the fifty-seven-pound crankshaft to tiny manila

the MOTOR

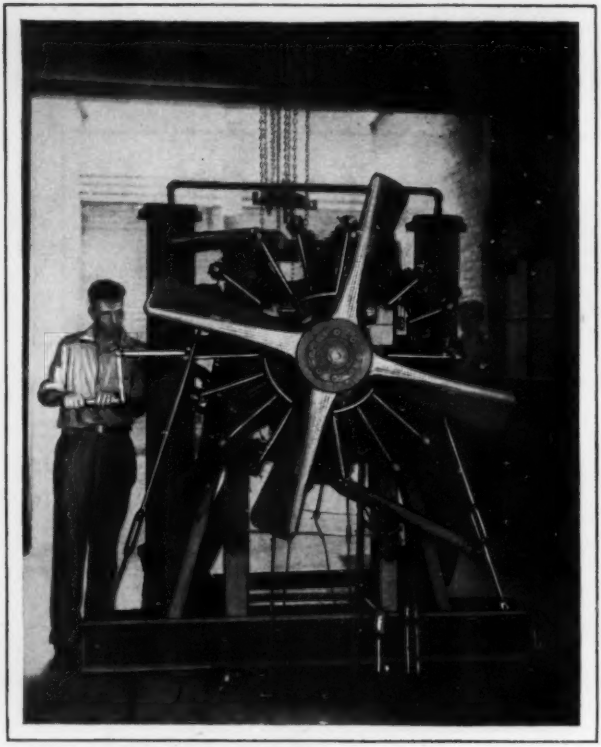
From the Supply of Parts on the Rolling Workbench, and the Cast Aluminum Crankcase in the Background, Another Airplane Power Plant Is About to Be Assembled

gaskets in the oil-suction line that weigh less than one-hundredth of an ounce. And every single washer, every screw and bolt and clip and plug and stud, has to be absolutely perfect.

While Maj. Carl Spatz and his four companions were piloting the "Question Mark" on her record-breaking endurance flight of 150 hours, forty minutes and fifteen seconds over southern California, the men of the Wright plant took the same interest. The company had telegraphic bulletins coming in regularly, reporting the progress of the flight. Copies were rushed at once to each department and every man in the factory felt that it was his work, his motor, that was being tested.

Once a motor is installed in a plane, there is no further chance for trying it out. It's not like an automobile motor. Thousands of feet above the earth, aviators, cleaving the sky at two miles a minute, have to depend on absolute performance on the part of the engine that holds them aloft. Henry Stopford, in the heat-treating rooms at Paterson, knows that if his work isn't exactly right, there'll be an airman's life at stake later on—unless the defect is caught on the test blocks before the motor leaves the plant.

The tester makes the final adjustments. For an hour he has been working away fitting a new motor on the test blocks, connecting gasoline feed and exhaust pipes, fastening a blunt, four-bladed propeller on the shaft, pouring in oil. At last everything is ready. He moves every tool and oilcan out of the way, takes a crank like a furnace shaker, inserts the end into the inertia starter, and cranks. The propeller blades do not move; the motor is not turning over. Presently the tester gives a final twist, still cranking, and moves a lever. The motor spins—a single



Cranking the Inertia Starter of a New Engine, Mounted in the Testing Laboratory for Its Trial Run

cylinder catches and gives it added speed; another—another—an irregular, sputtering roar. A smother of blue smoke—the cylinders have been primed with oil—flares from the exhaust pipes as the roar becomes deafening. The tester hurries from the room to escape the drive of air and fumes, slamming the door behind him. Alone in its twenty-foot chamber, No. 10,341 settles down to a steady roar, muffled now by the heavy walls.

One whole wing of the Wright factory is devoted to the testing department. The entire structure is roaring like a mammoth beehive. You can't hear yourself speak. The testers have cotton in their ears. Each motor has a whole room to itself, with a big open-air vent to the sky for the exhaust gas. First comes one of the long motor chambers, then an equally long room for the testers, with glass windows through which they can watch the mechanical youngster in their charge; then another motor chamber, and so on. Along the ends of the testing chambers runs a corridor, from which sliding iron doors shut away the separate rooms. Along the corridor two mechanics are pushing another new Whirlwind, on a little steel carriage, to a chamber that has just been vacated by one of its predecessors.

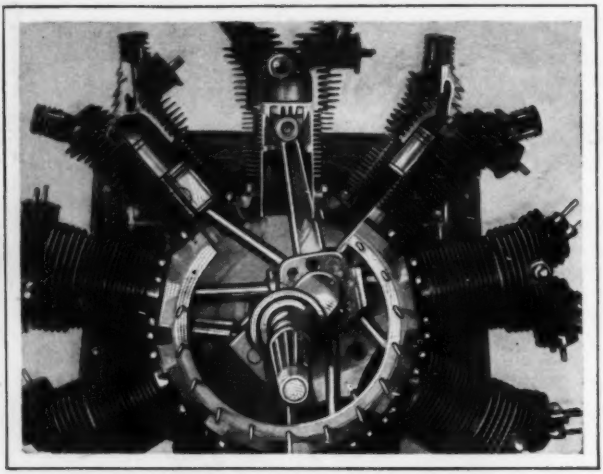
Beside the window on the wall of the testers' room is an instrument board, with a wall desk just below it. Cassimere Boll, if he happens to be the tester on duty here, climbs onto a high stool in front of the desk, glancing through the window at the flickering glint on the whirling propeller blades of No. 10,341. One of the dials on the board in front of him is the tachometer, that now shows the new-born motor is turning up 700 revolutions a minute, as steadily as its older brother that took Lindbergh to Paris. At the end of ten minutes or so, the throttle is opened a little, and the tachometer shows 800 r.p.m. Bit by bit the pace is stepped up until 10,341 is turning up 1,500 a minute. There it is held for half an hour or more. Then, after a breathing spell that lets it idle back to seven or eight hundred for a few minutes, it is "given the gun" and pushed up to 1,750—nearly a full load. Finally the throttle is pulled wide open, and it roars up to 1,800—and holds it. For hours it roars along, wide open, without a miss.

On the instrument board, beside the tachometer, are dials showing the temperature of the oil going into the motor, and of the oil coming out. There are also an air-pressure gauge and a gas-pressure gauge. A dial on an oil tank beside the desk registers the weight of the oil in the

tank; as it is used, the exact amount consumed can be reckoned at any time. Gasoline is measured in a tube at the top of the instrument board; from time to time the tester notes just how much is used in two minutes. There is one lever for the engine throttle and another for the carburetor-mixture. A chart enables the tester to compute at any time the power the new motor is developing at that particular number of revolutions per minute. A dial shows the temperature of the air entering the mixing chamber. A barometer shows the air pressure under which the motor is operating, so that this sea-level test can be turned into exact estimates of how much power would be generated at different altitudes.

Whether 10,341 is to carry a mail plane across the slopes of the Alleghenies, or take some private owner through blue air above the islands of the Caribbean sea, the men responsible for its performance must know just how much power it is going to be able to develop under either set of circumstances. There is a gauge to measure the vacuum in the cylinders. And

An Assembly Line in the Wright Factory; the Manifold Side of a Finished Motor, and a Workman Adding Cylinders to the Crankcase Assembly



A Sectional View of a Nine-Cylinder Radial Motor, Showing the Crankshaft, Connecting Rods, Pistons and Valves

two little levers operate switches on the right and left-hand magnetos, so that the motor can be run on either of its two sets of spark plugs, with a chance to see just how many revolutions per minute are dropped when one or the other ignition system is cut out.

The story of that motor, No. 10,341, or any other, begins months before, in the iron ranges of northern Minnesota and the pulp mills of New Hampshire. North of Duluth, the iron ore is dug from the hills, to be shipped across the Great Lakes to the steel mills at Gary, Ind., or transferred to rail and sent on to Pittsburgh. By the time the factory gets it from the steel makers, it is in varied form. There are tons of drop-forged steel for cylinder barrels, crankshafts, connecting rods, valve rockers, and so on, a special quality and shape for each purpose. The cylinder barrels, for instance, are cylindrical pieces of metal weighing more than forty pounds apiece, with a hole—less than the size of the finished cylinder—down the middle.

But drop-forged steel is only one of the ingredients that go into the making of a motor. There is sheet steel for the exhaust pipes and push-rod housings. There is an enormous quantity of aluminum, purchased in bars, for the crankcase, oil pump, housing plates, and all the rest. There is bronze or "composition" for the different bearings or bushings, and babbitt for the master rod, as the single big crankshaft bearing at the end of the one rigid connecting rod of a radial motor is called. There is a mass of what is known as "bar stock"—steel in long rods and bars of various shapes and sizes, from which nuts and studs and knuckle pins will be cut. And besides all this, there are things bought already made into a finished product, such as washers, gaskets, wiring, and other odds and ends that may include materials coming from halfway around the world—like the silk winding of some of the insulated wires, or the gaskets that come from the pulp mills already referred to.

When the first aviation engines were built in the United States, there was no one in America who knew how to pour aluminum for castings. Aluminum for kitchen utensils—that was easy. But aluminum castings that would stand up as parts of an airplane motor—that was quite another matter. Every part must have a certain strength, a certain hardness, and the certainty that neither the polar cold of a 40,000-foot altitude, or the terrific heat of a twenty-four-hour run in the tropics at high speed, would affect those qualities unduly. The combinations at the time the metal was poured, the successive chemical baths in the heat-treating processes, all had to be exactly right. Three men were therefore imported from one of the French airplane factories, where aluminum castings for flying motors had been made for some time, to show the workers here how to pour metal that would "stand up."

Two weeks go by before an aluminum crankcase casting is fully machined, ready to be assembled in an engine. This is not necessary for machining alone. A certain time must be allowed for readjustment of the metal between successive operations. Each man knows his metal, its peculiarities of stress and strain, its tendency to warp and run out of shape under

the heat generated by cutting tools. Each man knows how much heat the part he makes will stand before expanding; knows how much heat each cut involves; knows when to stop before warping begins. He will machine one part, then jump to another. He knows when a casting needs a "rest," and sets it aside for two days, or even three, before machining again.

By such careful procedure the crankcases are brought into shape without strain, machined thinner and lighter with no sacrifice of strength, worked slowly to the point where the finished piece is ready to play its part in the reliable performance of the motor, when the earth is spread out like a relief map far below the plane.

After all the various processes are finished, each motor is completely assembled, and rolled to a washroom, where it receives a final gasoline bath. Compressed air dries it, and away it goes on its little baby carriage to the testing chamber. After its six-hour run, it is taken completely apart and minutely looked over to see if any defects have developed. Then, when each separate part has again received a particular O. K., it is reassembled. Back to the test blocks for a final two-hour run—and it is at last ready for delivery.

Delicate Testing Apparatus, Including Microscopes, Are Used to Pass on Every Engine Part Before It Goes into a Finished Motor

The radial motor is still confused by some of the public with the rotary motor, such as the "Gnome" engine, used during the war. In a rotary engine the cylinders revolve and the crankshaft stands still. The radial engine, on the other hand, is a normal motor, with stationary cylinders and crankcase and a revolving shaft, carrying the propeller. No engine of the rotary type has been built since the war, but following the success of Charles Lawrence in developing the Wright radial, engines employing the same principle have appeared in droves. The success of the National Advisory Council of Aeronautics in developing a new cowling to cut down air resistance has enhanced its popularity.

HUGE MODEL OF PHILADELPHIA AIDS NEW RESIDENTS

Philadelphia, as it will appear when buildings now under construction are finished, is accurately represented in a huge model, eighteen by twenty-two feet in area. It is carefully built to the scale of one inch to 250 feet and gives an exact presentation, in miniature, of the skyline. City officials consider it a great aid to out-of-town business men and others who are considering locating in Philadelphia. The model was started in 1911. It was stored away for several years but was recently brought to light, and the latest developments were added.

Working on Part of the Huge Model of Philadelphia, and Two Buildings Shown in Insert, to Reveal Their Exact Construction and Realistic Details

ELECTRIC LIGHTS CHANGE HUES BY ALTERING CURRENT

Illumination and display effects, far different from any now possible, are seen as the result of an improved form of light under development at an eastern laboratory. The lights are described as "living colors of constantly changing hues" that shift without the flash and flicker of the usual bulb and effect the color cycle in the same light, instead of requiring sets of differently colored bulbs. Pillars and building columns, illuminated by these lamps, appear to glow like precious stones of ever-changing shades, goods on display in show windows are seen in constantly varying lights and yet the bulbs themselves are not colored at all. This interesting effect is obtained by a gas-filled light, somewhat like the neon gas lights

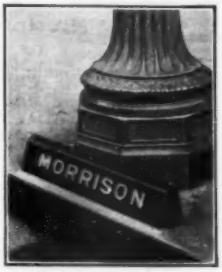
already common in towns and cities, but with the new light, the color keeps changing as the strength of the electrical current that causes the gas to glow is altered. The lamps are said to operate at about normal voltage and hence will be safe for home installation.

BURRO LINE BRINGS WATER SUPPLY TO DESERT TOWN

Water is carried by burros to supply the village of Hawthorne, Nev., not far from the location of the navy's ammunition depot, now under construction. The service is operated through a franchise granted by the state, and the rates are fixed at four and one-half cents per gallon during the week and on Sundays, but on Saturday evenings the price is increased to five cents. Seven burros with special pack saddles and water cans compose the equipment, and the animals are fitted with tail lights for night deliveries.

FLASHING STREET SIGN ON CURB EASILY SEEN BY DRIVERS

Names of streets are easily visible to drivers and others when placed on flashing signs that rest on the curb. The plates are out of the way of pedestrian traffic, are easily adjusted and are also legible in the daytime. They save confusion at intersections and are quickly altered or repaired.



¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

Model of Proposed Clubhouse for Aviators at Flying Field; a Roof Garden and "Bleachers" Are Interesting Features

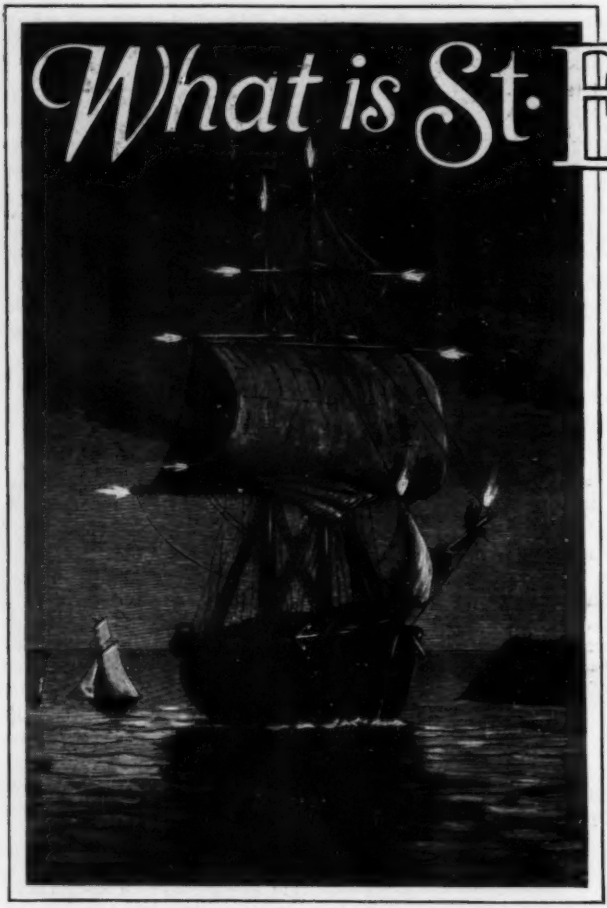
COUNTRY CLUB FOR FLYERS HAS NOVEL FIELDHOUSE

Bleachers on the roof, from which spectators may watch planes arrive and depart, an open-air roof garden, and other features have been incorporated in the fieldhouse of an aviation country club near Chicago. It occupies a plot on the club's 135-acre landing field which augments the other airport facilities in and near the city. A series of hangars is to be constructed for club members.

METALLIC COATING ON WOODS TO PREVENT DECAY

What is described as one of the greatest discoveries since the dawn of the steel age has been announced in an electrolytic process for coating wood and other nonconducting substances with metal. The treatment not only makes the materials less inflammable but protects them against the corrosive effects of chemicals, water and steam. According to present plans, aircraft for the British navy will be constructed partly of materials so treated. Metallized wood, for instance, gains in strength by more than sixty per cent and will not decay. The inventor of the process asserts that almost every industry will be affected by this development.

What is St. Elmo's



"On the Tops of the Masts and the Tips of the Spars," St. Elmo's Fire, as Described in a Familiar Stanza by Longfellow

By CALVIN FRAZER

A NARRATIVE of adventures at sea is hardly complete without a description of the weird lights sometimes seen during a storm at mastheads and yardarms and known under a variety of names, of which the commonest are "St. Elmo's fire" and "corposants." Everybody has heard of this phenomenon, though relatively few people have ever beheld it.

Because most of the accounts of the phenomenon mention only its occurrence at sea, many people doubtless think of it as exclusively nautical, but it has often been observed far from the ocean, and it is more common and striking in its manifestations on the summits of high mountains than anywhere else. One of its favorite haunts in this country is the top of Pikes Peak, Colorado, which is 14,110 feet above sea level. A display observed there one February from Colorado Springs, fourteen miles distant, was so bright that the lights were thought to be signals made by stranded hikers. Aviators sent to investigate flew for half an hour over the winter-bound summit but found no signs of human life.

St. Elmo's fire is a first cousin of lightning. It is an electrical discharge, less violent than a lightning flash, proceeding from pointed, elevated objects in which an electrical charge has been acquired by induction, owing to the passage of strongly electrified clouds or masses of air overhead. The discharge is usually accompanied by a hissing or crackling noise. This sound is often heard in the daytime when the light itself is invisible. The phenomenon is a good illustration of the power of points to dissipate electricity and can easily be produced artificially.

When a frictional electric machine is being worked in a darkened room all projecting sharp points in its vicinity become tipped with light. The violet glow, known as the "corona," seen at night along transmission lines carrying high-voltage current, is due to a similar leakage of electricity into the surrounding air. St. Elmo's fire sometimes assumes the same appear-

Gleaming Light Playing about Both Buildings and People at the Observatory on the Sonnblick (Austria), Two Miles above Sea Level, from a Sketch by A. von Obermayer in 1889

ance, when telegraph or telephone wires, wireless antennas or the steel stays of vessels become charged by induction and are brilliantly outlined in the darkness.

St. Elmo's fire may occur before, during or after thunderstorms, but it is also seen, in the absence of thunder and lightning, when rain, snow or hail is falling. In such cases, the falling drops or particles are strongly electrified and a discharge occurs between them and pointed objects near which they fall. On mountains, the phenomenon is especially common during snowstorms.

Long before the nature of the strange lights was understood, they were well known to sailors, and many nautical superstitions have prevailed concerning them. In ancient times, two of the lights seen at the same time were called "Castor and Pollux," and were regarded as a favorable omen, while a single light was called "Helen," and was thought to forebode disaster. According to another old belief, if the lights remain stationary, they betoken fine weather, but if they move downward a storm is to follow.

A marine observer on board the White Star liner "Germanic," en route from England to New York several years ago, reported as follows: "About 1:00 a. m. of the third, the whole heavens were one continuous blaze of most intense sheet lightning of a pale-yellow and green color. There were five or six peals of thunder, and a perfect deluge of rain lasted about fifteen minutes. During this time, the vessel presented a remarkable appearance. On the truck of the foremast there was a flame about a foot and a half high and a foot across and, from the truck to about thirty feet down the mast, balls of fire, half an inch to two and a half inches in diameter, were quickly running up and down the mast in a most agitated manner."

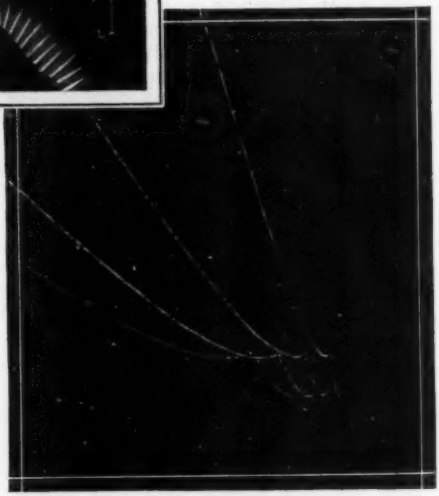
Some of the most magnificent displays of this phenomenon ever observed at sea attended the great volcanic eruption of

Krakatoa, in the Straits of Sunda, in 1883, when the air over the surrounding ocean was heavily laden with electrified dust from the volcano. One captain reported that, at a distance of ten miles from the eruption, the spars of his ship were "studded with corposants," and he noted the occurrence of "a peculiar pinky flame coming from the clouds which seemed to touch the mastheads and yardarms." On board another vessel, which was forty or fifty miles from the volcano, "the mud rain that covered the masts, rigging and decks, was phosphorescent, and on the rigging presented the appearance of St. Elmo's fire." The East Indian members of the crew hastened to put out this "fire" with their hands, declaring that it was the work of evil spirits and would scuttle the ship if it found its way below.

Before the establishment of mountain meteorological observatories, which date mainly from the last half century, reports of St. Elmo's fire on land were comparatively rare, but a few cases were recorded even in antiquity. One of the most striking is described in Cæsar's "Commentaries," where he says: "In the month of February, about the second watch of the night, there suddenly arose a thick cloud, followed by a shower of hail; and the same night the points of the spears belonging to the Fifth Legion seemed to take fire." There are three or four other ancient accounts of spear tips being thus illuminated with what was supposed to be a miraculous light, but was evidently an electrical discharge.

Electrical glows and flames have been seen on lightning rods and church spires in many parts of the world. The Egyptian pyramids are occasionally thus adorned, as the dry dust-laden air of the desert favors the occurrence of the discharge. The branches of trees sometimes show a faint bluish light. A case was reported from Austria not many years ago in which thousands of corposants were seen at one time in a mountainside forest. The hair and manes of horses are also sometimes thus illuminated, especially when wet with rain.

The spectacular displays seen on high mountains are explained



An "Electric Aureole" around an Alpine Climber; Two Views of Andes Summer Lightning, and Corona Discharge on High-Tension Electric Wires

partly by the fact that the electrified storm clouds are near at hand, often enveloping the place of observation, so that corona or brush discharges readily take place between them and terrestrial objects. Moreover, the mountains themselves, especially isolated peaks, act as pointed conductors in dissipating electricity. Another factor is the rarefaction of the atmosphere, which, as is known from laboratory experiments, increases the size of brush discharges. Concerning the displays witnessed at the former observatory on Ben Nevis, in Scotland, Angus Rankin writes:

"The most frequent manner in which the discharge makes its appearance is as caps of light on the tips of the lightning rods, but occasionally it appears as jets of flame projecting from all objects on the top of the tower. These jets are at times from four to six inches in length and make a peculiar hissing sound. During a very brilliant display, the observer's hair, hat, pencil, etc. are aglow with the 'fire,' but, except for a slight tingling sensation in the head and the hands, he suffers no inconvenience from it."

A Famous Incident in History, When the Spear Tips of Cæsar's Legionaries "Seemed to Take Fire"

Prof. J. E. Church, of the University of Nevada, has described a display that he witnessed a few years ago during a brief visit, in company with Capt. R. H. Brambila, to the small automatic weather observatory maintained under his direction at the summit of Mt. Rose, in the Sierra Nevada. Every projection from the roof of the building was seen to be giving forth electric fire. "Whenever," he writes, "our hands arose in the air, every finger sent forth a vigorous flame, while an apple, partly eaten, in the hand of Captain Brambila, sent out two jets where the bite left crescent points. To cap the climax, my felt hat above the brim flashed suddenly into flame. I could feel the draft and it seemed to me I could hear it, too. We felt no ill physical effects nor any special alarm, but for prudence's sake we sought the interior of the observatory, where the pranks of the electricity were completely avoided."

Many graphic accounts of St. Elmo's fire are found in the journals kept by the signal-service observers, who were formerly stationed, both summer and winter, at the summit of Pikes Peak. The observatory maintained here, which was at that time the highest in the world, was connected with the base of the mountain by telegraph. During the evening of August 18, 1878, says the observer, a "sizzling" noise was heard coming from the telegraph line, and the wire, for an eighth of a mile, was distinctly outlined in brilliant light, which was thrown out in beautiful scintillations. "Near us," he continues, "we could observe these little jets of flame very plainly. They were invariably in the shape of a quadrant, and the rays con-

A Favorite Haunt of St. Elmo's Fire, the Top of Pikes Peak, 14,110 Feet above the Sea, Showing the Rack-Rail Train

centrated at the surface of the line in a small mass about the size of a currant, which had a bluish tinge. These little quadrants of light were constantly jumping from one point to another of the line; now pointing in one direction and again in another. There was no heat in the light, and, when the wire was touched, only the slightest tingling sensation was felt. Not only was the wire outlined in this manner, but every exposed metallic point and surface was similarly tipped or covered."

Another journal entry reads: "'Singing' wire again this evening. Air intensely charged with electricity. At 8:00 p. m. the singing sound came with peculiar intensity, much like the sound produced by a carriage wheel on a roadbed of hard snow on a cold, frosty morning. The hair of the observer's head stood erect, crackled, and the pricking sensation of the scalp was extremely painful. To protect his head, he put on a black felt hat. Only a few seconds elapsed before he was fairly raised off his feet by the electrical fluid piercing through the top of his hat, giving him such a sudden and violent thrust that he nearly fell from the roof in his excitement. When the fluid began to thrust its fiery tongues into other parts of his body, he was spurred to a hasty but 'brilliant' retreat. He experienced a peculiar burning or stinging sensation of the scalp for several hours afterward."

A phenomenon much akin to St. Elmo's fire, that has come into prominence in scientific literature in recent years, is known as "Andes lightning," because the most remarkable displays of it are those seen over the crests of the Andes, in South America. During the warmer season of the year it is not uncommon at night to see the mountaintops continuously aglow, while at frequent intervals great beams of light, like those of a gigantic searchlight, shoot up to such heights that they are visible all along the west coast and even hundreds of miles out at sea. The natives have long regarded these lights as the reflection in the sky of glowing lava in the craters of volcanoes, but there seems to be no doubt that they are electrical discharges. Similar displays, though on a less magnificent scale, have been observed in the Alps and other mountainous regions. A few years ago, American meteorologists thought they had found an example of Andes lightning in North Carolina; but the once mysterious lights seen over Brown Mountain, in that state, proved, on investigation, to be merely the beams of distant locomotive and automobile headlights.

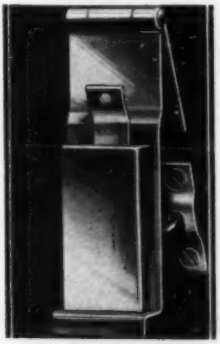
There are various other luminous phenomena, sometimes identified with St. Elmo's fire, concerning which science has little definite to say. For example, there have been reports for more than a century of a phantom "fire ship" on Bay Chaleur, Canada, said to make its appearance before a storm. Much information about this curious phenomenon was collected some twenty years ago by Prof. W.

F. Ganong, who believed it to be a case of St. Elmo's fire, but no explanation has been offered of its frequent occurrence in this particular place or of the shape—like that of a large burning ship—that it is said to assume. Still other phenomena, sometimes reported as St. Elmo's fire, may partake, rather, of the character of will-o'-the wisp, which remains one of nature's mysteries.

EAR TAG FOR RACING DOG TO PREVENT FRAUD

To prevent the substitution of greyhounds and other dogs in races, a British inventor has introduced an identification tag in the form of a disk attached to the dog's ear. Each marker is specially grooved for the records and is quickly identified by a master key which is fitted to the accuracy of one ten-thousandth of an inch. Attachment is painless.

HINGE HASP AND LOCK IN ONE ELIMINATE PADLOCK



Using a padlock, with its attendant uncertainty and likelihood of becoming lost, is unnecessary with a rust-proof unit recently introduced. The lock, hinge and hasp are combined in one assembly, the locking unit being arranged so that it is released simply by inserting the key and pressing. To close, the lock is snapped shut.

POWDERED FRUIT

Apples, prunes, plums and other fruits are collected from windfalls by a Danish grower and dried and ground into powder for cooking and for making jellies. The powder is said to retain the natural taste of fresh fruit, is easily kept and can be shipped in convenient packages.

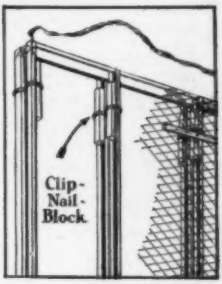
Speed Limit Painted on the Pavement, Where the Autoist Is Sure to See the Warning Sign

LINES AHEAD OF STREET ZONES HELP GUARD PEDESTRIANS

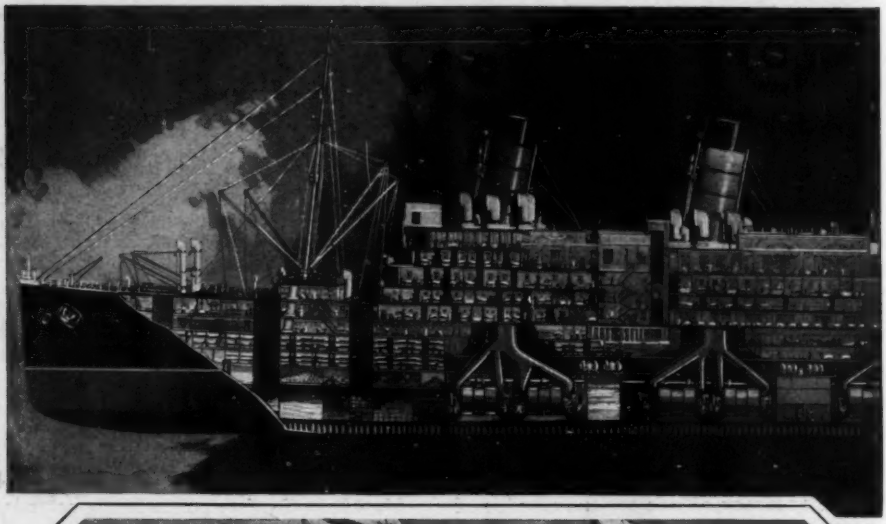
Marking off safety zones where persons may wait for street cars and be protected from autos has proved effective in reducing the number of accidents, but the idea has been improved in Los Angeles by marking guide lines a considerable distance ahead of the zone so that the motorist will be warned to slow down or steer out before he reaches the zone. In addition, figures indicate the speed limit.

NAILING BLOCK FOR TILE WALL REDUCES BUILDING COST

Nailing blocks for tile walls, or for metal-lath walls, have been introduced by a western manufacturer, to take the place of more costly plugs and to save time and trouble in construction. The block used with the tile wall is of spruce, fir or pine, and is grooved to form a strong binding surface. For metal-lath walls, a patented clip block is quickly attached to the upright at any place where nailing is later to be done.



FROM WOODEN WALL OF ENGLAND UNDER DRAKE



Top, Courtesy the Cunard Line; Bottom, Copyright, The Illustrated London News

Above Is a Reconstruction Drawing of One of Queen Elizabeth's Warships Which, under Drake, Defeated the Spanish Armada, and, Above, a Model of the Aquitania, on Whose Foredeck the Five-Hundred-Ton Wooden Ship Might Easily Be Carried

TO MODERN STEAM AND STEEL QUEEN OF THE SEA

HOW the ships of the world have grown since the "Wooden Wall of England," under Sir Francis Drake, repelled the Spanish Armada, with the help of a storm, has been demonstrated by the completion recently of a reconstruction drawing of one of Queen Elizabeth's warships. Contrasted to a similar interior model of the giant Cunarder "Aquitania," the little 500-ton Elizabethan warship might possibly have been carried on the giant modern liner's foredeck.

Although the ships of Drake's fleet varied greatly in size, the reconstruction painting shows general details that were typical of all of them. The upper gundeck formed a welldeck amidships, with small boats carried just forward of the mainmast. The forecastle opening off this deck and the forward half of the deckhouse at the stern were both pierced with gun ports, while the rear half of the sterncastle housed the main cabin and officers' quarters. Above, the halfdeck, or quarterdeck as it became more generally known, provided exercise and navigation space, and its forward rail, looking down over the welldeck, formed a defensive work in case the lower deck should be captured by boarders.

Beneath the upper gundeck was a lower gundeck, with portholes for a second row of guns, and beneath this, in turn, were the orlop deck, at about the waterline, and the holds in which powder and munitions, food, drinking water, and beer were carried, one entire hold being set aside for the latter commodity.

The "Half Moon," in which Henry Hudson discovered the river named for him, was very similar to this ship and other vessels of the same general size and appointments brought the early colonists to North America.

Compared to the Elizabethan ships, the great steel Cunarder, with its four funnels, mighty engines and tremendous speed, is a triumph of the shipbuilder's art. The model shows the arrangement of the interior, with cargo and supply holds under the forecastle; engine and fuel space amidships, and smaller cargo space above the four propeller shafts leading to the stern. The staircases and elevators between the first and second funnels serve the first-class staterooms, dining salons, smoke and lounge rooms. Second-class space centers about the third funnel, and the steerage space is situated lower and around the stern.

Huge Tabulation Board on Which Variety of Facts Gathered in Social Studies Are Analyzed and Classified

METER THAT TABULATES FACTS AIDS SOCIAL STUDIES

To summarize and classify data gathered in social surveys and other investigations, Prof. Henry J. Burt, of the University of Missouri, has devised a tabulation board which simplifies the task of analyzing results as shown by the many different facts obtained. The main unit in the apparatus is the board itself, eight feet high and sixty feet long and containing 135,000 holes lined into 576 divisions. Each hole stands for a fact or a subdivision of data, and these are recorded as desired by inserting metal plugs into the holes. In makng a summary, a moving frame is passed across the surface of the board and, as it moves, electrical connections are made through the metal plugs, with the effect that a complete count of all the facts represented is registered. For instance, after the whole length of the board has been run, the investigator would have before him, in the case of a social survey made of a community, a tabulated record of such facts as the sex, age, number of persons in a family, number of children, schooling, occupation, taxes paid, distance family lives from town, church connections, and may other details that would aid in preparing a "cross section" of the community. Scientists believe that such an apparatus will be valuable in many fields.

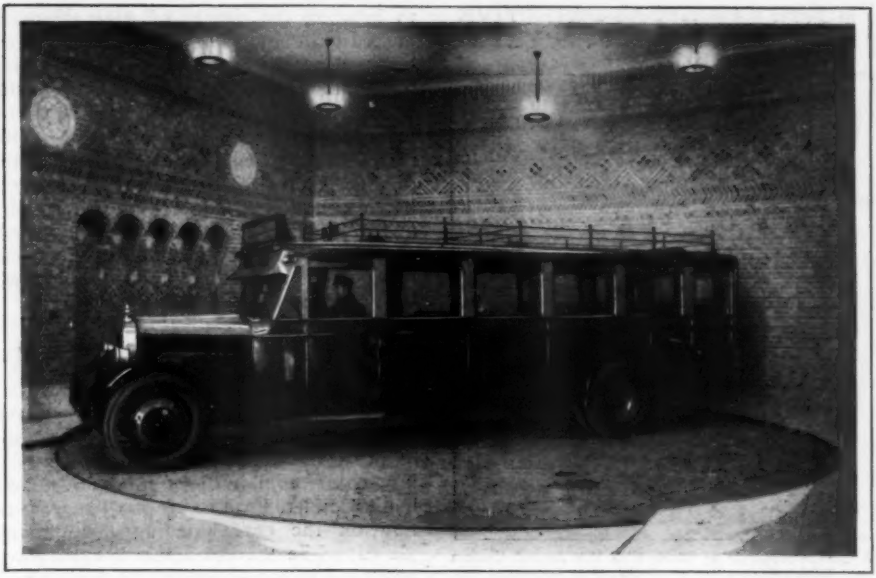
U.S. LEADS IN MILES OF AIR TRAVEL

Air traffic in the United States totaled 10,000,000 miles last year, as against 5,870,489 miles in 1927, tabulations by the department of commerce show. This was the greatest total distance flown by any country. Germany was second with 6,303,150 miles flown, but led in the number of passengers carried and the amount of baggage. More than 100,000 persons flew over the German commercial air lines and the planes transported more than 4,000,000 pounds of baggage and commercial goods.

PELLET-TOSSING GAME TESTS SKILL OF PLAYERS

It looks easy, but considerable skill is required to toss pellets into the proper colored rings or tubes of an amusement-park rack. Only certain colors and numbers of shots in each color win prizes, and the machine is set back ten feet or more. The rings are at an angle that makes it somewhat difficult to toss the pill into the right chamber.

¶Apple trees were introduced from Europe about 1629.



Turntable at Large Office Building in New York City; the Motor Coach Makes Regular Calls for Occupants Who Wish to Be Taken to Railroad Stations

TURNTABLE FOR MOTOR BUSSES RELIEVES CONGESTION

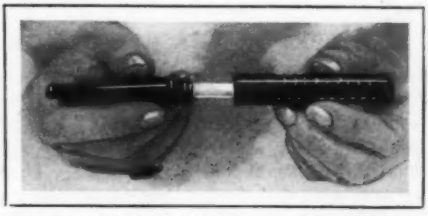
Large motor busses calling at a New York office building for railroad passengers, are easily turned about in a comparatively small space by a turntable, similar to that used on the railways. It is thirty-five feet in diameter and is installed at the end of a two-way road, leading to an inside terminal entrance where it would be difficult to reverse the direction of the busses without crowding and delays. The table spins them about in a few seconds. It is operated by a five-horsepower electric motor and will hold a load of 25,000 pounds.

RARE PLANTS IN DEEP JUNGLES SOUGHT BY EXPLORERS

Specimens of plants that never before have been collected by American botanists are among the objectives of a party of explorers from the Smithsonian Institution who have gone to the jungles of Peru and Ecuador. A few plants from this region are to be found in the United States. They were gathered by Richard Spruce, an Englishman who roamed through the equatorial jungles between 1830 and 1845, but no one has gone so far into these jungles as the present expedition proposes to do. The travelers are taking with them 20,000 sheets of special paper on which to mount the 30,000 or more plants they hope to obtain.

WIRE SCREEN OVER CIGARET PREVENTS SPILLING ASH

For greater safety and convenience in smoking cigarets, a wire screen and bakelite cover has been introduced. It prevents dropping sparks and ashes, does not interfere with the smoking and is an attractive addition to the usual holder.



Bakelite Tube Fitted with Screen Prevents Spilling of Cigaret Ashes and Glowing Stubs

MOVIE CAMERA AS DETECTIVE AIDS IN WAR ON SMOKE

A Smoke Reporter at Work with His Special Camera Which Makes Record of Offending Chimneys

A mysterious ticking issued from the big black box, and the young man standing near excited the suspicions of persons passing the factory, but investigation quickly banished the first suggestion that the man might be planning mischief. He was simply a smoke reporter, and the box contained a specially rigged motion-picture camera of standard make, arranged to expose the film at intervals for recording the smoke issuing from the chimneys. The final picture, projected on a screen, would show, in a few moments, smoke conditions at that particular plant, for the entire day. The reporter goes about his work cautiously, as he is not always welcome, but he labors in the interests of better health and comfort, and his camera has been carefully devised to give results of undoubted accuracy.

FUME-PROOF BRASS FURNACE GUARDS WORKERS' HEALTH

Better health for workers and reduction in the shrinkage of metals are said to be realized from an improved rotary pot, heated by gas, for melting metals. It is so arranged that fumes that often cause a troublesome malady, known as the "shakes," cannot escape. Shakes is due to inhaling the fumes of zinc which is melted with copper in the manufacture of brass. The symptoms are similar to those of pneumonia, and while the disease is not classed as fatal, its victims are forced to leave work and are often confined to their beds for some time. The new pot is made of a special alloy that withstands many heatings and is said to reduce the shrinkage of the metals from four or five per cent, as with the usual apparatus, to but one per cent. In America, the manufacture of brass ranks second to iron.

BRILLIANT COLORS OF BIRDS ADOPTED FOR PLANES

Airplanes painted with the brilliant colors and markings of the birds have begun to make their appearance. The striking color combinations of wings and bodies lend themselves to easy reproduction on the corresponding portions of planes, while the tail feathers can be reproduced in the elevator and rudder and horizontal stabilizers. The bird-plane idea, originated by Berry Brothers, of Detroit, whose lacquers were used, was first applied to a Stinson "Detroiter," painted to resemble the redstart.

NIGHT LIGHT IS AUTOMATIC AND SAVES CURRENT

For night use in sick-rooms, hospitals, bathrooms and other places, a small electric light goes on automatically when the larger bulbs are turned off. A single button controls both lights through a pendant switch. The attachment is simply screwed into the socket and the regular bulb reinserted. The night bulb is furnished in red, blue, green and black.

¶Capable of withstanding temperatures of more than 2,000 degrees Fahrenheit, a new metal alloy has been developed.

DOES HEAT FROM CITIES CAUSE MILD WINTERS?

Burning coal, gasoline and other fuels in our cities, and thus liberating millions of heat units to the outside atmosphere, may be one reason why the winters show higher average temperatures in recent years than they did two decades or so ago. This interesting suggestion is offered by Prof. William J. Moore, of the Polytechnic Institute of Brooklyn, who shows by careful analysis of the facts, that "heating the whole outdoors" is not an impossibility, but may very likely have a definite effect on the weather, especially in large cities. He takes New York as an example. "Heat from the gasoline burned in New York every twenty-four hours is sufficient to raise the temperature of a volume of air, 200 square miles in area and 200 feet high, three degrees every twenty-four hours," said Professor Moore. "The heat from both the coal and gasoline consumed—and most of this is eventually liberated into the atmosphere—would raise the temperature one degree over an area of 20,000 square miles even if the air were constantly being changed. Heat generated in New York city, if liberated as steam heat, would supply about eight billion square feet of steam radiator surface, or 4,600,000 radiators of the usual parlor size. Is it not quite possible that, if so large a number were operating in an area equal to that of New York city, they might have an effect even on the vast atmosphere? Smoke and the water vapor released in combustion of fuels also have an influence on the outside temperature." Professor Moore estimates that 9,000,000 gallons of water are released daily over New York by combustion of fuels of all kinds.

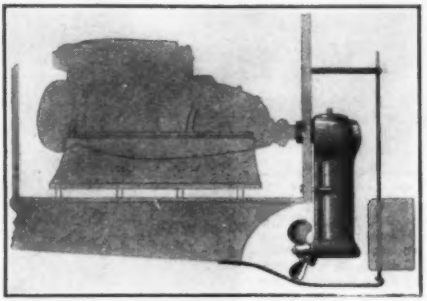
Patrol Wagon Used in London Is Fitted as a Combination Ambulance and Cell for Violent Prisoners

PRISON CELLS PUT ON WHEELS SERVE AS AMBULANCES

To handle violent prisoners, the London police department has special patrol wagons, fitted up as combination cells and ambulances. Besides the driver, a jailer is carried, and equipment for dealing with various emergencies is provided.

PROPELLER UNIT MOVES MOTOR TO REAR OF BOAT

By using an improved propeller unit now on the market, the motor of the runabout may be moved to the rear of the craft, leaving more room for passengers and simplifying construction as no shaft log is required. There is also a reduction of the fire hazard and oil cannot drip into the bilge water. The unit is suitable for shallow-draft boats and cruisers.



Propeller Fitting for Motor Runabout Enables Engine to Be Placed Aft

New Conveniences

"Folding" Electric Washer Is Raised for Use and Collapsed, as Seen in Circle, When Work Is Done, so That It Can Be Rolled under Table

Electric Toaster and Percolator Combined; the Toaster Shelf Slides Out by Pulling the Handle Indicated by Arrow; Set Is Ornamental and Adds to Appearance of the Breakfast Table; Bread Is Toasted on Both Sides at the Same Time

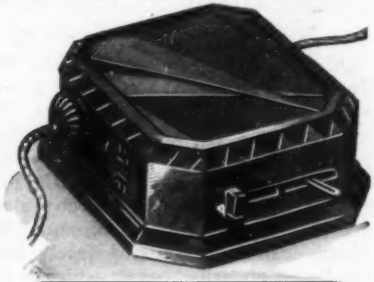
Removable Pan Handles for Use over Flame, or in Oven, Are Easily Locked On and Will Not Slip or Turn When Once Adjusted; at Right, an Economical Way of Using Soap; Place Cake in Grinder and Turn Crank for Flakes; Soap Lasts About Three Times as Long When It Is Used in This Manner

for Your Home

To Keep the Glass Top of the Percolator from Falling Off, This Spring Clip Is Easily Attached over the Knob and Fits Different Sizes

Table and Seats, a Complete Breakfast Nook, Card Table or Writing Desk Are Quickly Folded into This Attractive Cabinet That Extends But Four Inches from the Wall; It Is Also Furnished in a Built-In Model

It Does a Thorough Job of Sharpening; the Compact, Motor-Driven Knife Grinder Operated from Light Socket



Useful on All Sorts of Home Electrical Appliances; an Automatic Timer That Shuts the Current Off at Any Time between Two and Twenty Minutes, According to the Setting of the Adjustable Time Lever at the Right

Lock Faucet Tipped for Service as a Drinking Fountain; Water Stops Flowing When Handle Is Released

SELF-LOCKING WATER FAUCET SERVES AS FOUNTAIN

Fitted with a special handle that releases the water by a downward push and closes the flow when the pressure is released, a self-locking water faucet now on the market is easily converted into a bubbling drinking fountain simply by reversing the downward position of the nozzle. The faucet can be locked open so that the hand need not remain on the release knob.

CHEMICAL FOR COOLING MOTORS TO AID AVIATION

Air-corps engineers, at Wilbur Wright field, have developed a chemical to replace water for cooling airplane motors. Fewer gallons are required, making a reduction of more than eighty pounds in weight; a radiator one-fourth the size of the present type can be employed, thereby also decreasing wind resistance, and higher speeds can be developed safely because the liquid absorbs heat to a higher degree than water and there is, consequently, less danger of overheating. The chemical is expected to greatly enlarge the field for the present type of engine. Only minor changes are required to make the motors suitable for using the substance. Planes will be able to increase their payloads without a corresponding expense due to the reduction in the weight of the radiator and liquid carried, and higher speeds with consequently faster and more attractive schedules can be maintained. Army engineers, who have been testing the liquid for some time, report that the speed of a standard pursuit plane was increased eleven miles an hour by using the chemical since the weight was reduced. It boils at 387 degrees Fahrenheit, 175 degrees above the boiling point of water.

RESERVOIR TO IRRIGATE TREES PROLONGS THEIR LIFE

To supply trees with the proper amount of water and with liquid fertilizer, a cast-iron reservoir has been introduced for installation in the soil not far from the trunk. Irrigation is effected by seepage from the reservoir's perforations. The container is easily set up and requires practically no attention save a filling two or three times a week, regardless of rain. One reservoir is sufficient for the average tree but two may be needed for exceptionally large ones. According to experts, many tree ailments result from insufficient moisture, and this plan is said to be effective in keeping the soil about the roots from becoming dangerously dry. The fertilizer is placed in the water.

Drawing to Show the Tree Reservoir in Proper Place; It Needs Filling Only Two or Three Times Weekly

CHURCH IS RAISED AND MOVED ACROSS STREET

Moving a church weighing 16,000 tons across a street, turning it around, cutting it in two and making it thirty feet longer, is the interesting engineering task just finished in Chicago. The big structure, of brick and steel, 185 feet long and 115 feet wide, was safely rolled to its new location without cracking the plaster or breaking a window. The total distance traveled was more than 200 feet and the actual trip across the street, once the church was raised and the timbers in place, was accomplished in eight hours. Four teams of horses and arrangements of pulleys and cables furnished the motive power and tackle. Less than fifty men were required for the entire work. In the course of the operations, which consumed almost eight months, 50,000 feet of heavy timbers were employed, 4,000 jacks, 3,000 rollers and 400 tons of rails.

Chicago Church in Course of Being Moved across Street, and Diagram Showing Final Location

RUINS FOUND FROM AIRPLANES WITH AID OF CAMERA

Using airplanes to trace man's building of 3,000 years and more before the time of Christ, is the interesting method British explorers are employing to find ancient forts and other works that can be located only with great difficulty by usual search. Photographs taken from planes at a considerable altitude, reveal the queer, geometrical markings that indicate the location of old dwellings, fortifications and other habitations that long since have crumbled into dust. Careful study of the aerial views shows sites that have escaped detection of explorers on the ground. Such photography revealed the site of Woodhenge, in Wiltshire, England, a place like the famous Stonehenge.

How It Feels to Fall

Official Army Photograph, Showing Three of the Ten Rookie Parachute Jumpers Who Leaped, One after the Other, from a Sixteen-Passenger Plane during a Test at Chanute Field

"I WAS dropping feet first, and there was a terrible rush of air past my ears. Then I was rolling over and over on my side, next head over heels, and the rush of air hurt my ears. I reached over, grabbed the release ring and pulled. Something seemed to have put a pillow under me and I had fallen into it. The chute was open. I swung back and forth as if in an old-fashioned rope swing.

"I saw the ground coming up to meet me. I grabbed a handful of ropes, pulled down and held, and the swinging motion ceased. Then I grabbed another handful, pulled hard this time and almost stood still in the air. The next instant, my feet hit the ground. My legs were forward and I sat down, but got up again quickly and ran straight into the parachute to turn it inside out and spill the air out of it so that it wouldn't drag me. Everything was O. K. A few seconds later, they told me I had fallen nearly 3,400 feet before pulling the release ring."

Jack Cope, who has made nearly 2,000 parachute jumps in the last nineteen years, and has never suffered an injury in the business, was telling of his longest leap before opening the parachute. He started his career as a jumper before the days of the airplane, and was one of the first to make a parachute leap from a plane, a feat then considered highly impractical.

"All during the long drop, it was possible for me to put my hands on any part of the parachute within reach and I could see the airplane following me down. I could see the ground plainly and was never on the verge of unconsciousness at any moment. Except for the rush of air that pained my ears, there was no feeling that I would call uncomfortable. The jerk when the parachute opened did not hurt, and it never should hurt anyone if his harness is properly adjusted and of the right type.

"Jumping from such a height before pulling the ring, is purely a stunt, of

Where Will He Land? Jack Cope Ready to Step Off for a Drop into Space with His Parachute

course, and I doubt if anybody would ever be compelled to do such a thing. In fact, flying is so safe today that the parachute is hardly ever needed. Lighted airways, better planes, more competent pilots, frequent landing fields and many other factors are co-operating to make aviation safe in every way today, but I want to clear up a few points about this business of parachute jumping and possibly give a few hints that may help you in case you do have to jump some time.

"In the first place, the parachute that you will wear, if you get it from a reliable air passenger line or any other trustworthy source, can be relied upon. It is bound to open. Cases of parachutes failing to open are now almost unknown, for the simple reason that they are designed in such a way that they must open, if you pull the ring. At the top is a small pilot chute that snaps out and open on steel springs. It drags the big bag after it, and there you are, safe as can be. Do not worry about the chute.

"In the second place, the chances are you will have ample time to get ready and make a safe leap after your plane is disabled, if such an accident occurs. This is an important point to remember. Most people think that things happen as quickly in the air as they do on the ground—in an automobile accident, for instance. That is not the case. It may take the plane more than two minutes to fall 1,000 feet. If you were flying at a good altitude, say, of 5,000 feet or so, there would be plenty of time, usually, for you to step off safely after figuring out just what to do. Keep cool. Remember the parachute is like a life preserver. It is reliable and easy to use. You will be infinitely better off if

Coming to the Finish of the Long Drop; Cope, as He Neared the Ground after the 3,400-Foot Leap, before Pulling the Ring

you take the situation calmly. Not long ago, ten men successfully jumped from an army transport plane. They stepped off one after the other and were all clear of the ship in about eight seconds. The test was valuable, for it proved that a load of passengers, even in a cabin plane, could safely descend and all get out if order were preserved. But there is practically no necessity for parachutes in the modern cabin plane, so safe have these ships become.

"You don't jump when you leave the plane. You just step off. Count to three or five slowly before pulling the ring. The interval gives you time to fall clear of the ship so that the chute will not become entangled in the wings or other parts. There is a trick to stopping the swinging motion and to other points, but they are chiefly of interest to the professional jumper. You want to know how to get to the ground without injury and in the most comfort. As I have suggested, you'll have plenty of time to get ready for the actual landing on the way down. When the moment comes, have your legs forward in such a way that you'll strike on your heels. The shock isn't severe and you can decrease it by pulling up on the supporting ropes just before you land. The effect is about like jumping unsupported from a height of ten feet. If there is a wind and you are going to be dragged when the chute gets to the ground, pull on the ropes on one side and run into the chute to turn it inside out and release the air that has gathered in it."

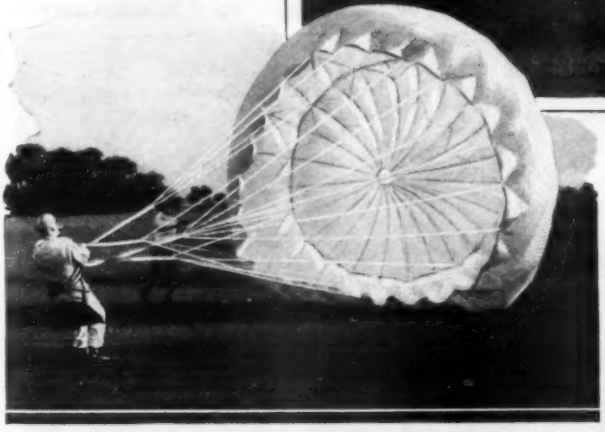
Cope made his first jump from a balloon early in the summer of 1910. Those were the days when the parachute thriller was the main event at "Old Home Week" and similar celebrations. He had been employed around the balloon as a fireman, to quench sparks with a sponge soaked in water, and finally persuaded the manager to allow him to go up. The parachute at that time was a cumbersome outfit, suspended from the balloon, the jumper hanging below, some fifty feet under the big bag. To cut loose, the jumper pulled a rope which operated a knife, severing the cord that held the parachute to the rigging.

"The rope to pull on was tied with a blue ribbon," said Cope. "The manager told me to ride the balloon until I heard a pistol shot. One shot meant that I was high enough and could drop O. K. Two meant to jump at once, and three signified that I should stay with the balloon and not drop. All I had to do was to grab hold of that rope with the ribbon and pull down with all my might.

"The balloon got away all right, and I found myself swinging back and forth in the air like a pendulum. After what seemed a very short time, I heard the report of the pistol. So I took hold of the rope and gave it a terrific jerk. Down I

went. It looked to me as though the parachute was going to fall on top of me, but suddenly it opened and I floated easily down into a big pasture. That was my first jump and I thoroughly enjoyed it, as I have all my close to 2,000 jumps. I have landed on houses several times but always have managed to steer clear of water, and have never been hurt. I have always been careful and have refused many propositions because my better judgment told me that they involved too great risk.

"After that first jump, I had varied experience in balloon work and continued to use the stretched or fully extended chute until late in 1911, when Ed Hutchinson, of Elmira, N. Y., packed a chute and made a double drop, using one chute wrapped in a bundle and the other stretched. Then came three, four and five drops, done by packing one parachute under the other and releasing them successively until the last one was reached. George Sewell and I made twenty-two drops from one balloon at the Wheeling, W. Va., state fair in 1912. George cut twelve chutes and I cut ten. I don't believe anyone has beaten that record.



Navy and Marine Parachute Jumpers Landing after Leaping from Plane, and View of Cope as He Reached the Ground

"At this time, Capt. John Barry was experimenting with a parachute that he had packed in a round funnel-like container and was fastened to the underside of an airplane. Many thought it was impossible to make a jump from a plane, so, when he was successful, he received a great ovation and much deserved publicity. Others started to try it, and late in the fall of 1912, I joined up with Rodman Law, a brother of the well-known queen of the air, Ruth Law.

"The best system we could devise was

to use a balloon chute, hold it as a bundle in our arms, sit out on the edge of the plane, jump off and then throw the chute up in the air and let it open as we fell. Rod tried it out first, but the only thing wrong was that the parachute failed to open! He fell, feet first, into a soft marsh, but luckily was not injured, although we had to get a horse and pull him out with a rope. He was up to his arm pits in the soft mud. But he made a successful jump the next day.

"I weighed about 105 pounds at this time, and since Rod was some forty-five pounds heavier and was not feeling any too well, we decided that I had better try the jump. Airplanes were not as safe and stable as they are today, and it took some time to climb to the necessary altitude for the leap, about 800 feet. I was out on the wing of the plane and, when we were high enough, I slipped off, the parachute in my arms. As I fell, I gave it a hard throw. It opened and I landed O. K.

"A little later we tried another method of using the parachute with the plane. We packed it in a bag and tied that to the airplane. The bag was laced across the bottom and we had a long web belt on the chute. This was fastened to the waist. When we were ready to jump we would hang down under the airplane and cut the laces of the bag. Our weight would pull the parachute out. To keep the chute from falling out as a bundle we would tie its top to the bag with a piece of twine so that it would stretch to its full length before becoming detached altogether. This was practically the same arrangement that we had with the regular balloon chute.

"Planes and pilots were rather scarce in those days, and few pilots were sold on the idea of using a parachute at all. But after a year or so, Floyd Smith, a Chicago boy, started some experimental work with the result that he produced a back-pack parachute of the type that was used in the army in 1916-17 and '18. This chute was made of the very best grade of silk and was packed very carefully in a small bundle and harness that fits the wearer. A small pilot chute was made, with strong steel springs that opened when released, pulling the larger parachute out after it. Constant improvements have been made on this original plan. The army, navy and

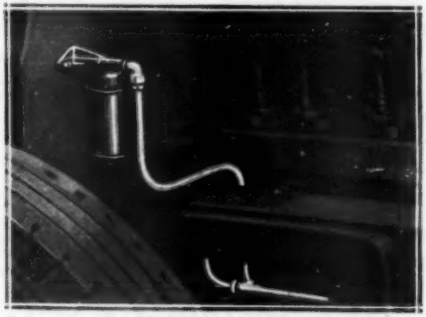
Parachute Instructor W. T. Dodson, Second from the Left, and His Crew of Navy Flyers, Who Gave Exhibition Jumps at the National Air Races in Los Angeles

marine corps now use the back-pack, seat-pack and chest-pack types of parachutes, and these forms are in general use throughout the world of aviation. In the last few years, they have been instrumental in saving 100 lives or more.

"The parachute has reached a state of relative perfection today and is little thought of in connection with exhibition or stunt work, but principally as a valuable life-saver. Colonel Lindbergh used it on three different occasions and many other flyers have joined the ranks of the 'Caterpillar Club,' the organization of men who have made successful parachute jumps. I predict that parachutes will be needed less in commercial aviation, but doubtless they will be employed in wartime flying and in various other air maneuvers. I simply want to repeat that making a jump is not nearly as terrifying an experience as you may imagine; that it is real sport and will end happily, if you keep cool, do not hurry, use your head all the time and pull that ring."

"DECARBONIZER" INJECTS SALVE THROUGH AUTO INTAKE

A device for removing carbon from automobile engines is now available as a permanently installed accessory, operated at will by a manual plunger on the dash. In a small screw-top container on the front side of the dash is placed six ounces of a carbon-dissolving fluid of salvelike consistency, and the container is connected by tubing to the intake manifold. When carbon is to be removed, the engine is started, run for a few moments at average speed, until the normal driving temperature is attained, then the plunger is pulled and the chemical released into the manifold. The engine is stopped and allowed to stand for several hours, to give the chemical time to loosen the carbon deposit. When it is started again the carbon flakes are blown out.



Carbon Remover Permanently Fitted Under the Hood, Ready to Release Chemical into the Engine

Removing Particle from Eye with Aid of the Magnetized Steel Probe Which Often Saves Cutting

STEEL-MAGNET EYE PROBE REMOVES FOREIGN BODIES

Made of a special steel which has unusual magnetic properties, a probe for removing foreign bodies from the eye or other parts, has been introduced. Its sharp point permits insertion into the area; it is shaped for convenient use, and may be sterilized without damaging it.

STATIC SPARK FROM FINGER IGNITES GASOLINE

Static electricity has been found responsible for many fires and explosions indoors but an interesting instance of its effect outdoors has just been reported. Two students of the Western State College of Colorado were cleaning clothing by churning the garments in a pan partly filled with gasoline. The work was being done outside of the house. One of the men laid down the plunger and attempted to pick the clothing out of the pan. As he did so, a spark shot from his fingers, igniting the gasoline.

Getting the Most

THE POPULARITY of the dynamic speaker is the result of its exceptional tone quality and the faithful rendition of tone variations which distinguish good music and clear voice articulation. Arriving at a time when the radio public was demanding high-quality reproduction, this speaker seemed ideal from the standpoint of tone, power and compactness. The dynamic principle is not new and many of our readers remember when it was introduced a few years ago as a dynamic horn which, for several very good reasons, quickly passed out of favor although for a time it was quite popular. Next in favor came the cone speaker operated with a permanent magnet, and the cone possessed advantages not found in the horn. The dynamic principle with its strong magnetic field, a feature not possible with the permanent-magnet unit, soon resulted in its successful combination with the cone.

Perhaps every owner of a dynamic speaker has at some time or other wondered if his speaker was connected to the receiver in the correct manner to obtain the best possible results. If the receiver is one of the expensive factory models of the console type, the owner has no cause for worry on this score as the dynamic speaker and set are designed for each other. However, in the custom-built and homemade installations, or where a magnetic cone speaker has been replaced by a dynamic type, he may well be concerned about the matter.

One feature all dynamic cone speakers have in common is a lightweight movable coil, or similar device, fastened directly to the cone. This moving voice coil, or ring, is in series with the step-down output circuit or the step-down transformer supplied in the base of the speaker unit, and traverses a powerful electromagnetic gap, as shown in Fig. 1 (page 124). There are two methods of energizing the field of this moving coil; some speakers are designed for use with a 6-volt storage battery, the field winding in this case being connected to the same A-battery that supplies the set. Later models employ a step-down transformer and a dry rectifier unit together with a filter to supply 6 volts of d.c. from the a.c. house-lighting line. Circuits of this type are shown on page 124. In factory-built sets, the field is energized from the power unit, which is a part of the installa-

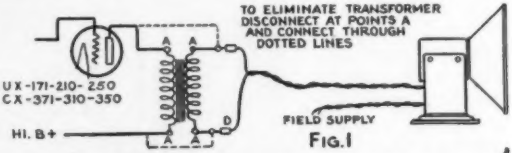


FIG. 1

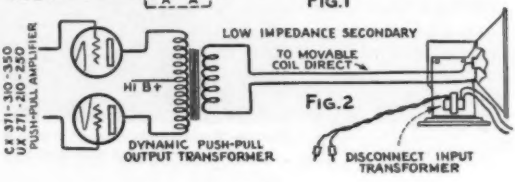
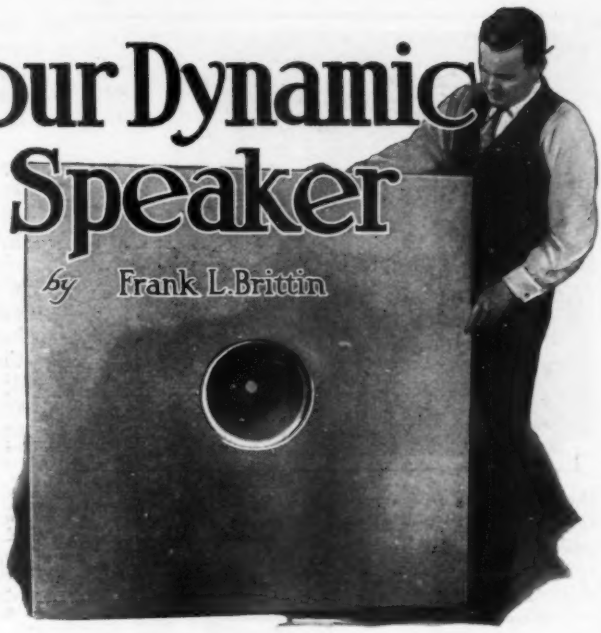


FIG. 2

Out of Your Dynamic Speaker

by Frank L. Britton



tion, and the reader need not concern himself with the details. However, if the power unit employed with the custom or home-built receiver is of a good modern type, the builder can provide taps for energizing the field coil of the dynamic speaker.

Diagrams 1, 2, 3 and 4, on pages 120 and 121, show the proper manner of connecting standard dynamic speakers with various types of amplifiers, to match the speakers with the output of the sets. Fig. 1 shows how to eliminate the output transformer in the set when a transformer of the proper type is already incorporated in the speaker unit. Fig. 2 shows the method of removing the speaker-unit transformer from the circuit and connecting the speaker to a specially designed dynamic push-pull output transformer in the set. A dynamic speaker may be connected directly to a push-pull choke system, as shown in Fig. 3; Fig. 4 shows how to eliminate the secondary of a push-pull transformer to use the primary winding for the choke method if desired. In both Figs. 3 and 4, the 4-mfd. condenser must be of the heavy-duty filter type. When the owner is satisfied that the output of the set and the speaker are properly connected and matched, the next thing to do in getting the most out of the dynamic speaker is to eliminate or suppress line hum and design the baffle so as to prevent booming, or what is commonly called "barrel tone." Many of the factory-built installations are not free from such effects and owners of them may also profit from the following instructions:

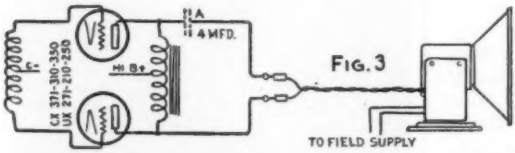


FIG. 3

TO FIELD SUPPLY

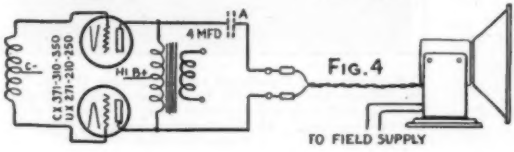
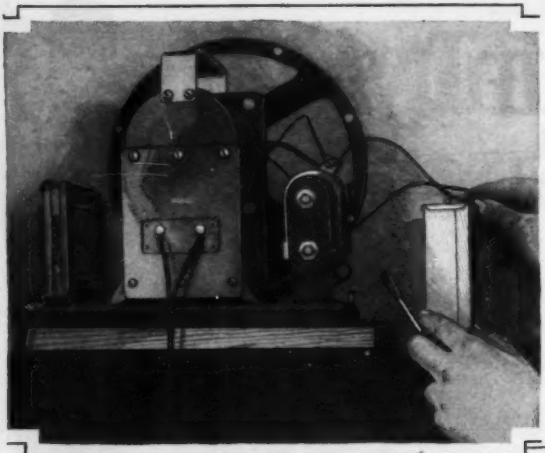


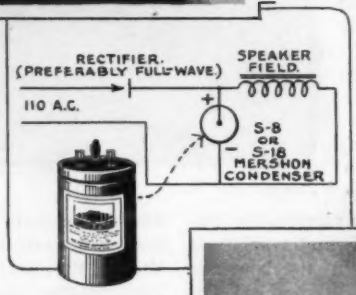
FIG. 4

TO FIELD SUPPLY

In the case of the dynamic speaker in which the voice coil is energized by a 6-volt storage battery, there will be no hum, but in the a.c.-operated types, there is usually some hum which may be loud enough to be troublesome. Several manufacturers have designed their units so as to provide condition adjustments, and other devices for keeping this hum at a minimum. When these methods fail, the use of a special A-filter-type condenser, as shown in Fig. 2, on page 124, often helps. These high-capacity low-voltage condensers are now available for this purpose. When connecting



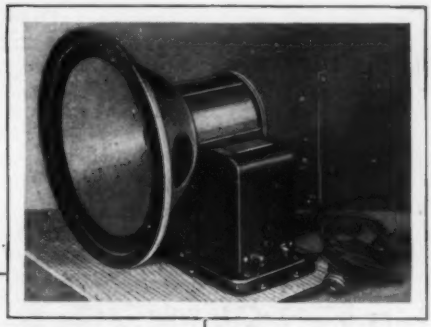
them, be sure to locate the proper terminals which will place the condenser across the coil. Note that there are two wires leading from the step-down transformer to the rectifier unit, and that there are also two wires leading from the terminals on this unit down to an opening in the electromagnet housing. It is across these last two leads that the condenser is to be placed. The A-filter condenser is usually provided with one red and one black lead, and the red lead must be connected to the positive post on the rectifier unit. The polarity can be easily checked with a small voltmeter. Unless the condenser is specially designed for this purpose, when placed across the field winding in connection with the dry-disk type of rectifier, the greater current, passing through the rectifier due to the presence of the condenser, will shorten the life of the rectifier unit. In the case of high-voltage types of rectifiers using vacuum tubes, this method works best and, of course, there is no danger of injury to the rectifier. The tendency lately has been toward the use of a high-voltage rectifier in series with the speaker field, drawing about 60 to 80 milliamp., the rectifier working directly from the 110-volt a.c. line, as shown in the diagram on this page. Occasionally thermionic and gaseous rectifiers are used with a step-up transformer as a separate unit to supply the field current. In any of these cases the use of from 8 to 20 mfd. of condenser ahead of the speaker field, shunting the rectifier output as shown, will cut down the hum to a point where it cannot be heard or even felt when the fingers are pressed on the speaker cone. Line hum may also be reduced by the installation of properly designed filters across the supply line to any electrically operated power apparatus. Such filters are now available at reasonable prices. A more recent idea for hum elimination in the dynamic-speaker voice coil is the introduction of a small adjustable resistance of 2 or 3 ohms, connected

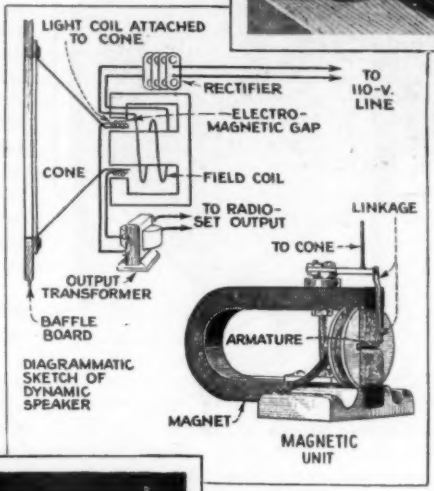


Top, Connecting Condenser across Speaker Coil to Reduce Hum; Center, Special Condenser Ahead of Speaker Field Shunting the Rectifier Output; Below, Auditorium-Type Dynamic Speaker Employing a Type-380 Full-Wave Rectifier

in series with the transformer field winding. The a.c.-voltage drop across this resistance is then fed, in opposite phase relationship, into the moving-coil circuit, which results in a balance by which zero hum is obtained.

All manufacturers of dynamic speakers recommend the use of a baffleboard for satisfactory operation. Without the baffle, the sound waves issuing from the front and rear of the cone mix in such a way as to cancel each other in the low tones. A few have obtained very good results with small properly designed cabinets, such as the Gothic type shown in the lower photo on this page. Low booming notes, obtained with dynamic speakers housed in many small cabinets, are not true low notes; they are a type of distortion known as resonance notes and not what is desired. They will often tend to fool the ear, however, when heard from sets weak on low notes, and some sets now on the market profit thereby.

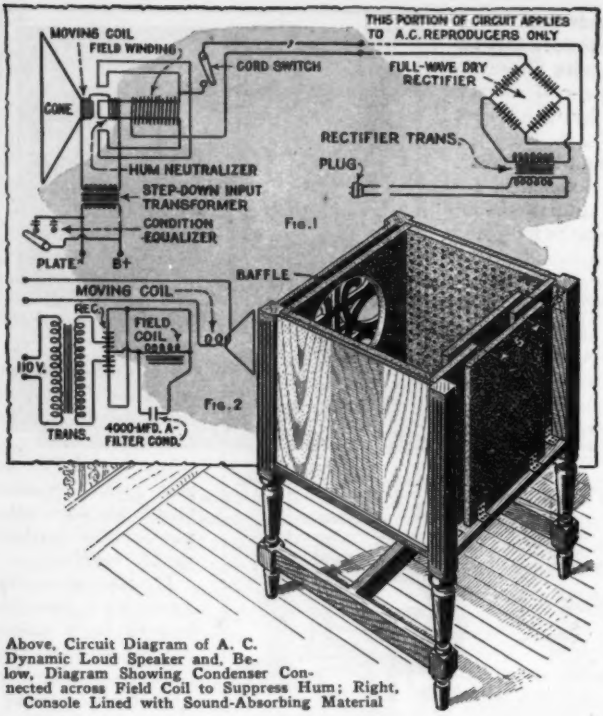




Above, a Typical Dynamic Speaker; Center, Diagram Sketch Showing the Difference between Dynamic and Magnetic Speaker Units; Below, Dynamic Speaker Housed in a Small Cabinet of Gothic Design

If the dynamic speaker must be housed in a small box, or console with limited space in the speaker compartment, the method suggested in the sketch on page 124 may be adopted to obtain very good results. A piece of plain celotex, in which a hole of the necessary diameter has been cut, is used for the baffleboard and is placed in the front of the cabinet behind the grill. The interior of the cabinet is then lined with acousti-celotex as shown. Further improvement can be effected by leaving the rear of the compartment open and mounting several celotex panels on suitable brackets, in a staggered arrangement, at the rear of the speaker compartment. The absorbent material, so mounted, tends to cut down the vibration of air in the compartment, greatly reducing the resonant effect and making possible true low notes.

The new dynamic speaker cabinet, shown at the lower right on page 124, is designed to eliminate undesirable resonance effects by extending the side outward from front to rear. One or more openings should always be provided in



Above, Circuit Diagram of A. C. Dynamic Loud Speaker and, Below, Diagram Showing Condenser Connected across Field Coil to Suppress Hum; Right, Console Lined with Sound-Absorbing Material

the back of any dynamic speaker cabinet to permit sound produced by the back of the cone to escape. If this is not done, objectionable resonance effects are bound to occur; baffleboards are not expected to act as a sound board nor to vibrate in sympathy with the cone of the speaker, as many think.

The ideal baffleboard for home use should be from 2 to 3 ft. square; the required size for the baffle may be easily determined, since the shortest distance from one side of the cone to the other should be at least one quarter the wavelength of the lowest frequency desired. The speaker unit should be placed behind it on a shelf of the proper height to center the cone, and the felt-cushion ring on the front of the cone housing should be tightly and evenly pressed against the baffleboard. The unit is then screwed down through the holes in the base. For best results, the baffle should be at least ⅜ in. thick, the thicker the better; the type for small theaters shown at the top, page 121, consists of celotex, 4 ft. square and 1¼ in. thick. This installation, when tested in Popular Mechanics radio laboratory in connection with a specially designed amplifier, produced excellent results. However, as in the case of most research experiments, there is, of course, still room for improvement. As a matter of fact, the very best speaker and amplifier now available develop an electrical efficiency of only about 50 per cent, and this is obtained by employing a push-pull amplifier of special design constructed of expensive material.

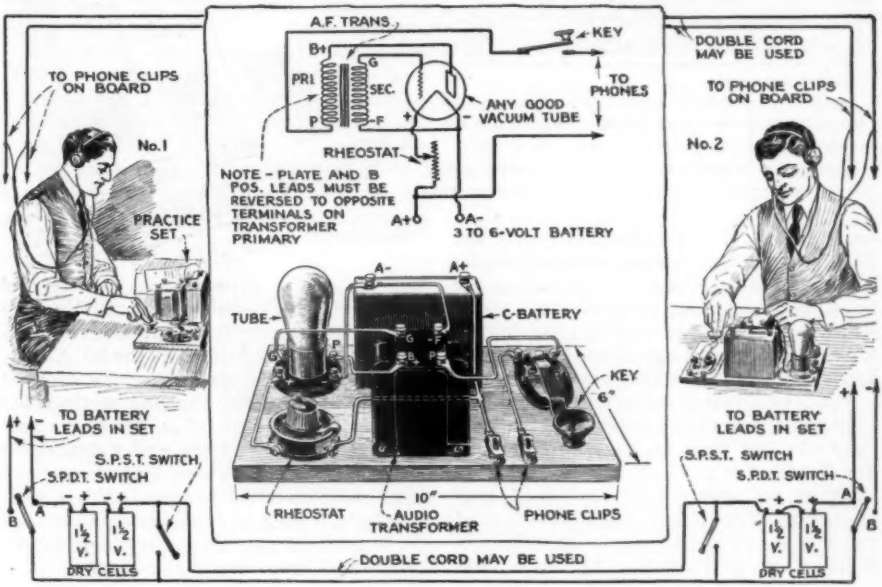
The electrical efficiency of most of the popular installations is only about 30 per cent, even with push-pull amplifiers, and with single power tubes the efficiency drops as low as 20 per cent. The larger the capacity of the amplifier which feeds the loud speaker, up to a reasonable limit, the better the quality of reproduction will be with a good speaker. A well designed amplifier with two 250-type tubes in push-pull in the last stage will produce very good results; if a smaller output is employed, there is bound to be a sacrifice in quality, especially in the production of the low tones.

Where space permits and the experimenter desires to make the necessary financial outlay, excellent results may be obtained by using two or more dynamic speakers in the same baffleboard.

One very interesting experiment for those who have the necessary facilities for carrying it out, is to mount a dynamic speaker in the center of a large wall space. There should be no obstructing surfaces either back of or in front of the speaker, unless they be of porous material or draperies to hide the installation.

A Modern Code-Practice Set

The popular use of short-wave sets and adapters has stimulated a desire to learn the code. The old-style buzzer does not give the clear-cut note heard from modern tube transmitters, but this note can be obtained and the pitch changed at will with the practice set described and illustrated in this article. It is inexpensive to build and employs only simple parts, usually already in the possession of the experimenter. Although it is an oscillating circuit, the output is so small it will not radiate and no license is required to operate it. The circuit is shown in the schematic diagram; the parts consist of an audio transformer, a socket, a rheostat, a battery of from 3 to 6 volts, according to the type of tube used, and a key. Where two beginners wish to practice together, two sets of the above parts and four s.p.d.t. switches as well as four dry cells will be required, as shown in the diagram of the complete two-way hookup. To test the single hookup, connect the phones and turn up the rheostat; then, when the key is pressed, a clear steady note will be heard in the phones as long as the key is held down. The pitch is varied by adjusting the filament rheostat. A 4½-volt C-battery may be used for either a 199 or 201A tube and is reduced by the rheostat to 3 volts for the 199 tube. To use the two-way system, operator No. 1 closes the switch to contact A, operator No. 2 throws his switch to B and then operates the key. No. 1 does the copying while No. 2 learns to send. The switching is reversed for the reply. The two s.p.d.t. switches across the line are left open at all times, except when one party wishes to practice alone. He then closes his line-shunting switch and throws his operating switch, as in the case of operator No. 1, to B. The rheostat is then readjusted and he can transmit to himself. Operator No. 2 can hear him but cannot reply as long as No. 1 has his switch across the line closed. Always open all switches when code practice is discontinued. The two-way hookup is the quickest method of learning to send and receive code correctly.



Tube Booster Handles Six Tubes

A convenient tube booster of the homemade type, which will take care of up to six tubes at once, may be built at small cost. It is useful to any set owner, and especially to the service man as a timesaver, by enabling him to rejuvenate a number of tubes simultaneously instead of one at a time at the rate of one tube every 30 minutes. It is designed, of course, only for the standard 201A-type of tube or similar tubes, having an impregnated thoriated-tungsten filament. Either alternating or direct current may be used for heating the filaments during the boosting process. A step-down transformer of the bell-ringing or similar type, having a 6-volt tap, may be used on the 110-volt a.c. line, or a 6-volt storage battery.

If a step-down transformer is used, the voltage applied to the tubes must be carefully checked with an a.c. voltmeter. If dry A-cells are used, groups of four cells in series are required for each 201A-type tube, and the voltage must be checked every few minutes as the voltage drop is rapid. Dry cells, therefore, are not recommended. If tubes of the 199-type are to be boosted, a 4-volt filament supply is required, and in case dry cells are used for this purpose, three cells in series are required for each tube in the booster. Either a 22½-volt B-battery, or wet cells supplying this voltage, is connected as shown for 201A-tubes to supply the flashing voltage.

The parts required are as follows: one good-sized cigar box; 6 sockets; one 30-ohm rheostat; four binding posts; 3 ft. of bus-bar wire; 12 ft. of flexible, rubber-covered hookup wire, and one single-pole double-throw switch. The table gives the resistance settings for different numbers of tubes of the 201A-type. The numbers arranged above the rheostat pointer indicate the rheostat settings for various numbers of tubes, the lower row being for the A-battery and those above for the 22½-volt battery. These settings must, of course, be obtained with a suitable voltmeter, and provide a quick means of setting the rheostat to the desired resistance as indicated on the chart.

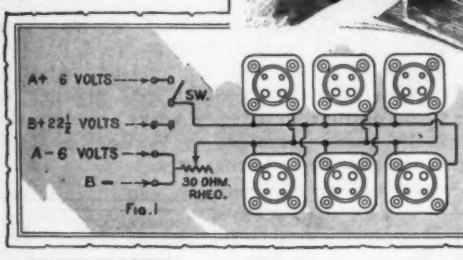
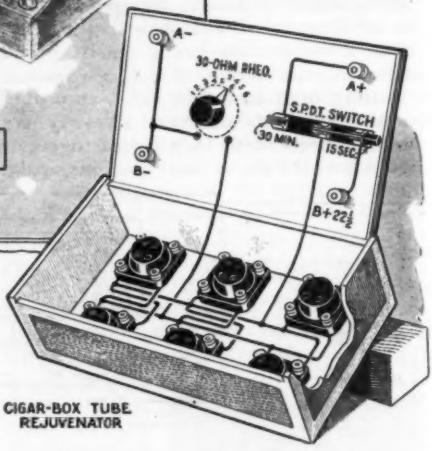


Fig. 1



CIGAR-BOX TUBE REJUVENATOR

FOR TYPE 201-A TUBES

	1 TUBE	2 TUBES	3 TUBES	4 TUBES	5 TUBES	6 TUBES
FLASH AT 22½ VOLTS 15-SEC.	10-OHMS	20-OHMS	24-OHMS	25-OHMS	26 OHMS	27 OHMS
AGE AT 6 VOLTS 30-MIN	4-OHMS	14-OHMS	18-OHMS	19-OHMS	20-OHMS	21 OHMS

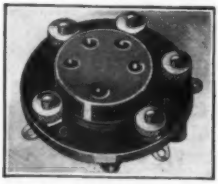
The flashing voltage for one type 199-tube is 10 volts for 30 seconds and the aging voltage is 4 or 4½ volts for 20 minutes. For one type-120 tube, the flashing voltage is 10 volts for 45 seconds, and it is then aged at 4½ volts for 20 minutes.

The construction details are so clearly shown in the illustration that no further comment is necessary. The flexible leads should be long enough to allow the lid of the box to be raised to the position shown, and all instruments are in plain view except the rheostat, which is mounted on the top of the lid.

Intermittent Signals in A. C. Set

The writer was recently called in to a friend's home to look at an a.c. receiver which would work normally for two to five minutes; the signals would then die away only to come in again after another five minutes. Examination showed that the type-227 a.c. detector tube would light up when the switch was thrown on, and the set would work normally for a few minutes, then the tube would go out and then light again. A new tube in this socket worked perfectly, and upon examining the defective tube it was found that the heating element had broken in two. Trouble of this nature is not uncommon in the d.c. radio receiver. Dirty contacts between the sliding arm and the winding of a rheostat cause a high-resistance contact which produces a similar erratic action of the tubes that take their filament supply from it. Unsoldered connections in any set which is called upon to carry 1 amp. or more of current may also develop similar trouble.—R. J. Plaisted, Cleveland, Ohio.

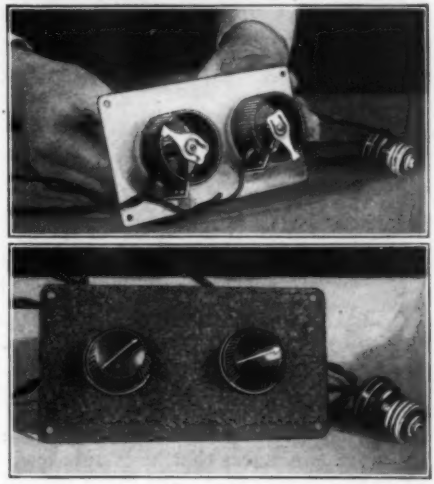
Socket for A.C. Detector Tubes



The tube socket shown in the illustration is a spring-supported shock-absorbing type, specially designed for a.c. detector tubes. The supporting element is balanced on springs, reducing microphonic disturbances, and tends to lengthen the life of the tube.

Simple Television-Motor Control

The device shown in the accompanying photos is a simple and effective dual resistance for the purpose of controlling the speed of television motors. It will give a fair range of speed and also keep the television image in its frame. The rheostats are 20 and 50 ohms, respectively, or two 50-ohm for greater speed range.

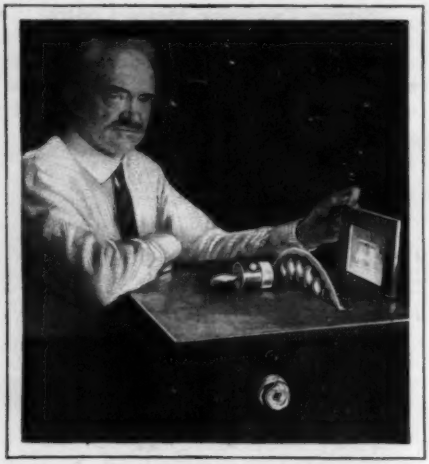


Rear View of Television-Motor Control Ready for Mounting, and, Front View Showing Control Knobs

Overloading the Neon Lamp

The neon lamp used in television experiments may be easily damaged by overloading. In the case of the standard neon, or kino, lamp, the current should be limited to 25 milliamp. for long life. This is obtained by operating on 235 volts with a 50,000-ohm adjustable current-limiting resistor in series. The illumination from an overloaded neon lamp is, of course, greatly increased, but the life of the lamp is correspondingly decreased. The neon gas is quickly lessened or exhausted, as the result of the overload. This causes a change in color of the glow from the normal rich pink to a sickly lavender.

¶Popular Mechanics' radio department offers its information service free to all readers of our magazine, and will promptly answer all inquiries.



C. Francis Jenkins Operating One of His New Radio-Movie Devices

New Radio-Movie Transmitter

C. Francis Jenkins, noted Washington inventor, announces that he is now ready to supply broadcasters and radio fans of the country with his new apparatus for the transmission and reception of radio movies. This includes television, except that scenes are not transmitted direct. They are first taken on a strip of film, sound and all, from which copies are made for distribution to various broadcasters.

Many Receivers Now Obsolete

The owner of an old set is handicapped as far as receiving the full advantages of modern broadcasting. The wonderful programs and splendid tone values now available are practically wasted in the receiver that was the last word a few years ago. Such owners are not listening to the deep rich tones possible in modern receivers and loud speakers. All the crudities of 1924 and later dates are still present in such installations and the user may, or may not, be aware of the fact. Merely adding a modern speaker will not help matters, as the trouble lies in both the speaker and the set. Conditions have changed and the modern circuits have kept pace with these changes. Good modern sets can be built for less than the older types cost, and it is not a good idea to try to use obsolete parts in the new set. Many of the old parts are unsuitable for the new circuits, although rheostats, binding posts, and condensers, where they are a good low-loss type, may be used, as well as much of the panel material. Sockets, coils, by-pass condensers and the various fixed and variable resistors, now necessary for the new circuits, should be of the best and latest design if good results are to be obtained. New tubes, requiring the special circuits and modern parts now available, make possible greater distance, volume, and infinitely better tone quality with less tubes.

Protecting the Receiver

When the service line is used as antenna for the radio receiver through any of the light-socket antenna-plug devices now in common use, or when A and B-eliminators are employed, the receiver is subject to damage just as if it were connected to an outside antenna without a suitable lightning arrester. Lightning disturbances may be brought into the receiver by way of the light wires and a suitable arrester should be connected in the circuit between the radio receiver and the 110-volt outlet.

Simple Automatic Radio Control

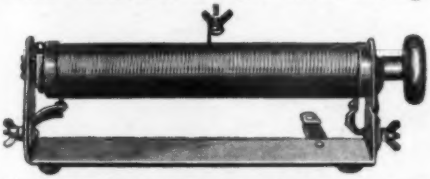
The attractive clock shown in the illustration is equipped with a switching device for automatically turning on and off the modern electrically operated radio receiver at any predetermined time. It may be set for the reception of any particular program, and may also be set to start the receiver for the morning exercise, or to shut it off without returning to the set. It is inclosed in a cast-metal frame, 6 in. high, 5½ in. at the base, and 2½ in. deep. A flexible silk cord is provided to connect the controller to the radio receiver. The clock may also be used to control household electrical appliances, such as lamps, hall lights, fans and washing machines.

Better-Service Kinks

An antenna, if placed too near another, may cause interference. This may be avoided by running them at right angles, and, if it is necessary to cross another antenna, by keeping them at least 4 ft. apart. Long-distance reception may be improved by trying various-sized gridleaks larger than the one now being used in the set. The efficiency of a tube should not be determined by measuring the plate current, but by measuring the emission. Short a.c.-tube life is often caused by poor line-voltage control. Damp weather sometimes causes poor contact in volume controls, producing noisy reception. An ordinary 60 or 100-watt lamp, mounted in the receiver cabinet and lighted for a short time each day during the period of dampness, will eliminate this form of trouble. Dampness affects coils, condensers and other apparatus, and is especially troublesome in tropical climates, where this idea of using a lamp to dry out the set will prove well worth while.

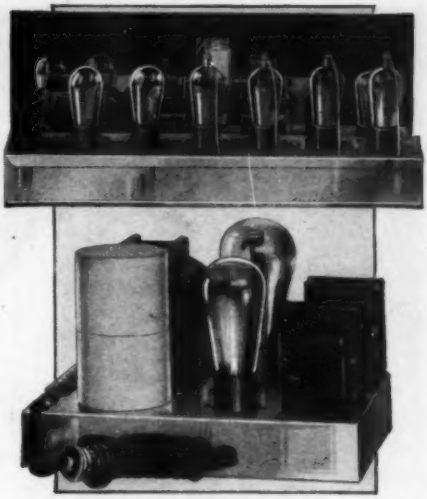
Heavy-Duty Laboratory Rheostat

A heavy-duty rheostat of the graphite-disk type is now available for general laboratory purposes. The unit shown in the illustration takes up much less room than the usual laboratory rheostat, has a capacity of 200 watts and will handle a maximum current of 40 amp. The resistance is varied by means of pressure applied on the disks (or released) by means of an adjusting screw operated by an insulated knob. If the disks are placed under considerable pressure, the resistance is very low. On the other hand, if the pressure on the disks is decreased, the resistance increases and the current flowing



Handy Rheostat for Laboratory, Showing the Compact Assembly

through the unit is reduced. This provides stepless, noiseless, and non-inductive control of the current.

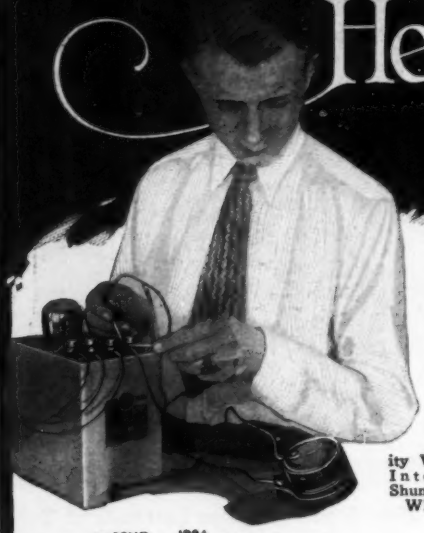


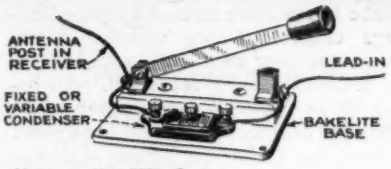
Completed Receiver Showing Tubes in Position; Amplifier and B-Supply Unit with Power Tube

New Super Employs Screen-Grid Tubes

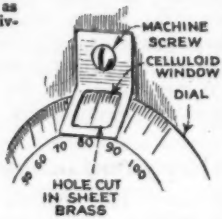
A new super employing four screen-grid stages, tunable intermediate transformers and a type-250 power-output tube is now available for the builder. Only one tuning dial is provided, and the receiver may be built for a.c. heater-type or d.c. tubes as desired. Nine tubes are used, and there are four screen-grid stages employing five hand-tuned air-core transformers of the filter type. These stages operate at a frequency of 475 kilocycles which enables one-spot tuning; the trimming condensers peak the stages for maximum sensitivity and 10-kilocycle selectivity. The separate power amplifier and B-supply may be used with any receiver in place of the last audio tube. Adjustable plate voltage, up to 350 volts, is available as well as terminals for operating a 110-volt a.c. dynamic speaker. The unit is very quiet and employs a self-healing filter condenser; it is only 11 in. long by 7 in. wide and 7½ in. high and comes assembled and wired. The tone quality of the amplifier is exceptionally good and free from background noises, so frequently heard in similar installations. All parts are available to the home and custom-set builder. The chassis may be obtained either wired or unwired and for either a.c. or d.c. operation.

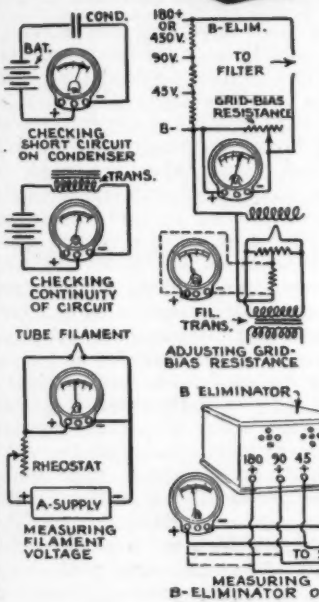
Helpful Hints

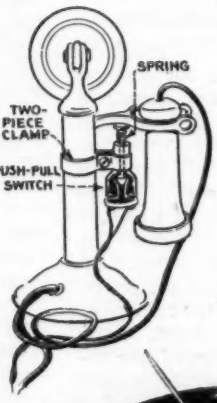




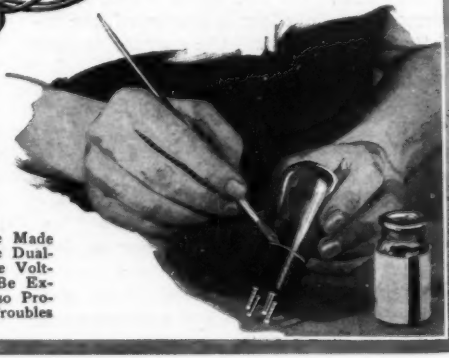
Above, a .0001-Mfd. Condenser, Connected as Shown, Improves Selectivity When Strong Locals Interfere; the Switch Shunts the Condenser Out When Not Required





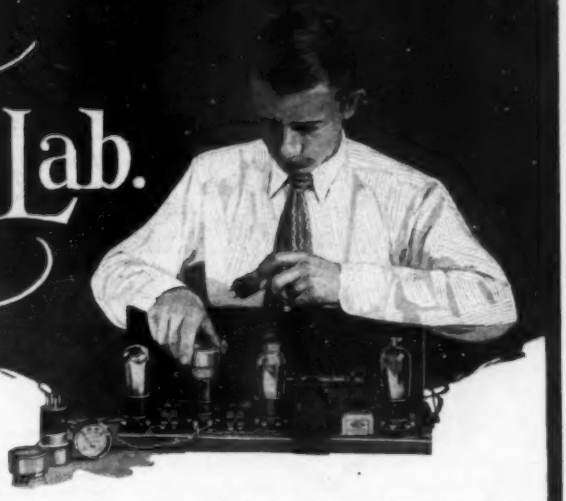


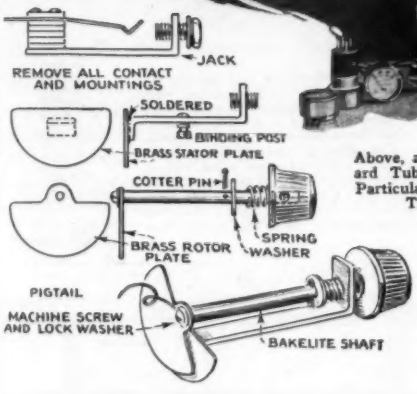
Above, Dial of the Old Bevel-Edge Type Equipped with an Index Line for Precision Work; Brass Sheet, ½ In. Wide and 1¼ In. Long, Is Cut and Mounted as Shown; the Line Consists of a Length of Bright Wire Soldered behind the Window; Left, Switch in Supply Line, Mounted on Telephone, Shuts Off Set When Phone Is in Use; Below, Wood Alcohol Softens Cement to Reset Loose Bulb in Base



Above, Several Important Tests That May Be Made with a Standard B-Eliminator Voltmeter of the Dual-Range Type; Correct Filament, Grid and Plate Voltages Are Necessary if Good Results Are to Be Expected from Any Receiver; the Instrument Also Provides a Means for Quickly Locating Circuit Troubles

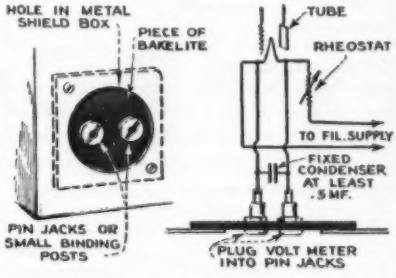
from the Radio Lab.



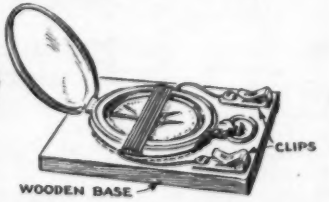


Above, a Handy Balancing Condenser, Made from an Old Jack and a Few Odds and Ends; the Plates Are Cut from an Old Condenser and Are Separated 3-32 In.; the Insulated Shaft Prevents Hand Capacity

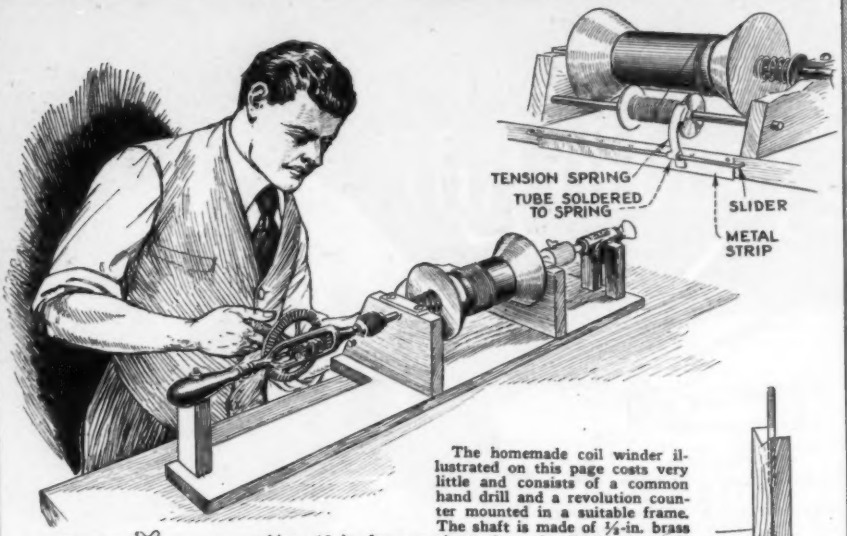
Above, a Test Kit, Made Up of Meters Mounted on Standard Tube Bases, Provides an Individual Meter for Each Particular Test, Which Is Made by Simply Removing the Tube and Inserting the Proper Socket Meter



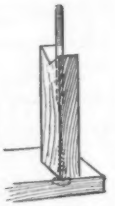
Above, Pin Jacks or Small Binding Posts May Be Mounted on a Stage Shield as Shown, to Permit the Use of an External Voltmeter for Checking the Filament Voltage of the Tube Mounted within the Shield

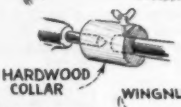


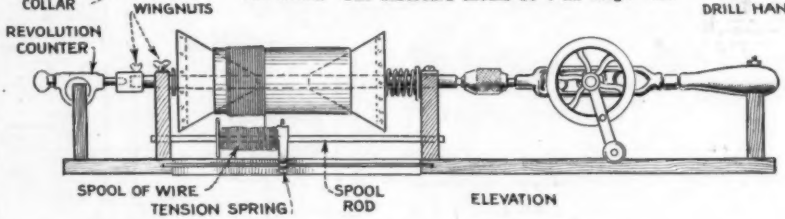
Above, an Experimental Galvanometer Made from a Pocket Compass; 38 Turns of No. 28 Wire Are Wound on the Compass, as Shown, and the Ends Brought to Clips on the Wooden Base

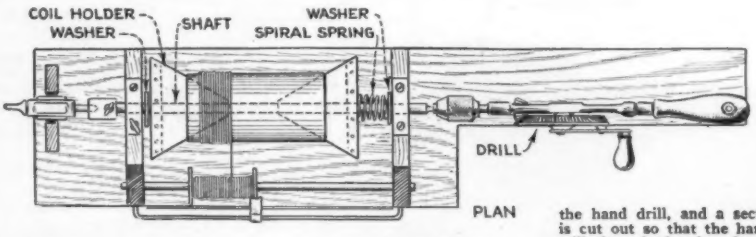


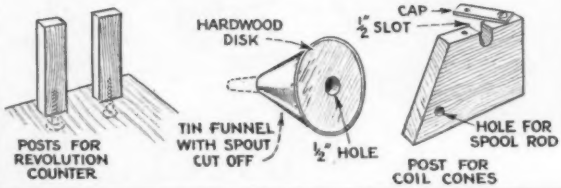
The homemade coil winder illustrated on this page costs very little and consists of a common hand drill and a revolution counter mounted in a suitable frame. The shaft is made of ¼-in. brass tubing, 15 in. long; a short piece of solid brass rod is turned down to fit into the drill chuck and is then brazed into one end of the tubing. Two tin funnels are prepared, as shown below, to serve as chucks to hold the coil forms. The baseboard should be 4 in. longer than the hand drill, and a section is cut out so that the handle will clear the baseboard when it is turned. The details are clearly shown in the diagrams and should require no further elucidation. If, however, any reader should desire additional information, Popular Mechanics Radio Department, 200 E. Ontario St., Chicago, will supply it.









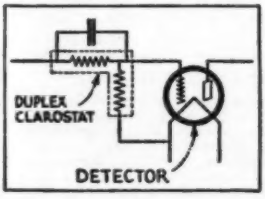


Four Factors Determine Good Reception

Good-quality reception depends on four major factors in any set. The first factor is the fidelity and efficiency of the loud speaker; the second is the circuit design of the receiver. The circuit must have the required tone-frequency characteristics and correct constants for the particular types of tubes which are to be used. Third, the tubes must be in good serviceable condition and be the correct types for which the circuit is designed. The fourth factor is the correct voltages for these tubes; this is a common cause of trouble and usually very easily remedied.

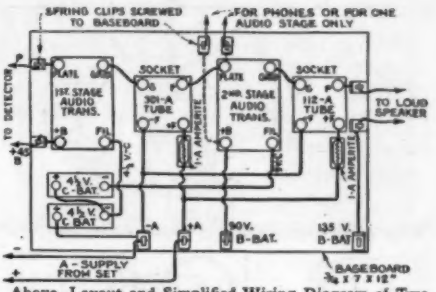
Double Gridleak Improves Detector

The double gridleak shown in the accompanying circuit is made up of two adjustable resistances which now are obtainable in one unit. There are two methods of employing the usual gridleak, namely, in the grid lead and shunted by the grid condenser, or across the grid and grid-return leads. The latter method is used when there are condensers or other obstacles to the proper draining action of the gridleak. By combining both methods, as shown in the diagram, remarkable sensitivity is gained and the tone quality is said to be greatly improved, owing to proper leakage control. The idea is especially worth trying these days, when many cleared channels make possible real distance reception.



Beginners' Audio Amplifier

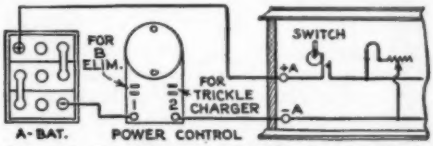
The simplified diagram shows an efficient arrangement that will enable the beginner to add either one or two stages of audio amplification as desired. It may be used with either a standard-broadcast or short-wave tuner of any battery-operated type. The output of the detector tube is taken directly to the first stage a.f. transformer, replacing the phones, and no alterations are required in the tuner itself. If the two-stage unit is desired, mount the various instruments on a baseboard, as shown, first making sure that the board is thoroughly dry and free from knots. Spring clips are used for terminals, or an insulated binding-post strip may be used if preferred. If one audio stage only is required, the board need be only half the size specified. In this case only one 4½-volt C-battery is used, and the plate terminal of the first tube socket and the 90-volt positive B-battery lead are taken directly to the two terminal clips above, as indicated by the dotted lines. One audio stage is sufficient for distant reception with phones and will give loud-speaker volume on locals. Where speaker only is employed two audio stages are best.



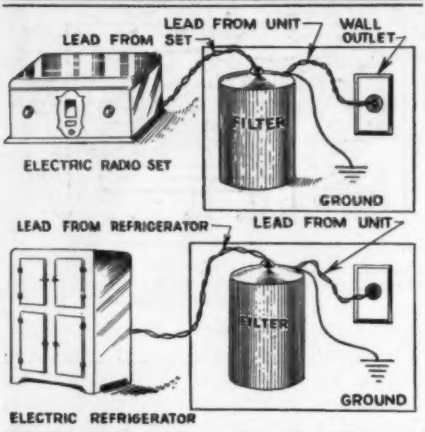
Above, Layout and Simplified Wiring Diagram of Two-Stage Audio Amplifier

Universal Automatic Power Control

An automatic power control of the series-type for either a.c. or d.c. is now available. It is designed for use with sets having a current draw equal to or greater than six tubes of 199-type. The unit is easily installed, as it is merely connected in series with either side of the A-battery, as shown. The B-eliminator and trickle charger are then plugged into their respective sockets, which are plainly marked. The switch on the set now automatically controls all power units.



Automatic Power-Control Unit, Showing the Simple Connections Necessary for Its Installation



Interference Filter Connected in Supply Line to Set, and, Below, to Electric Refrigerator

Universal Filter Kills Line Noises

Designed to eliminate all a.c. and d.c. line noises, a new filter may be used with electric sets, eliminators or electrical household apparatus, and is said to perform this function without appreciable loss of volume and considerable gain in tone quality. Used with the radio receiver, the unit is simply attached to the light socket and the supply lead from the set, the same connections being made for household apparatus. In some cases, the noises heard in the loud speaker are not from the line feeding the set, but are caused by some electrically operated appliance in the immediate neighborhood, and a portable loop set will enable the operator to locate the source of the trouble quickly. The ground lead from the unit may be used or not and should be tried both ways to determine the best method for the particular interference problem at hand.

An emergency antenna may be made by dropping a length of insulated wire out of the window where the height from the ground is sufficient; another simple method is to wind a few feet of insulated wire about a lamp cord, with the lamp plugged into the lighting circuit. The capacity between the lamp cord and the twisted wire is sufficient to bring in signals from powerful near-by stations.

How to Use the New A. C. Power Tube

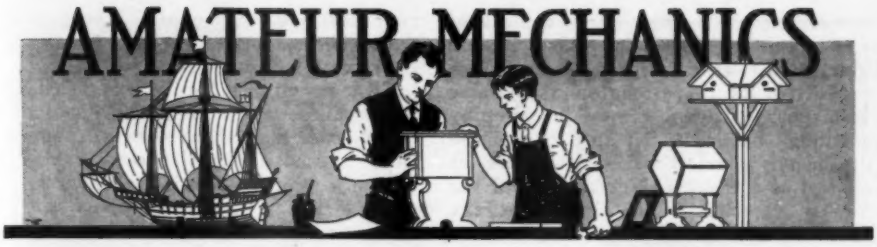
The popularity of the new type-345 a.c. power tube is not surprising as it has the outstanding advantages of operating on a moderate plate voltage, and using the same 2½-volt filament supply as is required for the usual a.c. heater tubes. A further advantage lies in the fact that it provides more than twice the undistorted output of the 371 power tube now in common use. The new type-345 power tube has an undistorted output of 1,600 milliwatts, as contrasted with 700 milliwatts for the 371-type and 1,700 milliwatts for the 310-type. The application of the new 345 power tube is largely experimental. The resistance requirements for its proper application are a center-tapped resistance of 60 ohms, connected across the filament terminals for the grid return, and proper grid biasing. This is usually obtained by means of a 1,500-ohm metallized resistor or powerohm of 2½-watt rating, shunted by a 4-mfd. condenser, which is placed in the grid return lead from the negative B, if the plate voltage is 300 volts or over.

FOR THE RADIO BUILDER

The simplified blueprints listed below include the best of Popular Mechanics tested circuits. When ordering, simply quote the numbers of the blueprints desired and inclose the proper amount in an envelope addressed to Popular Mechanics Magazine, Radio Dept., 200 E. Ontario St., Chicago, Ill. Back magazines containing full descriptions of the circuits can also be obtained. Inclose an additional 25 cents for each magazine desired, giving date of publication.

No. 111, Homemade Tube Tester . . July 1926 . . 25c
No. 115, 15 to 550-Meter Three-Tube Receiver . . . . . Nov. 1926 . . 25c
No. 116, Three-Tube Loop Set . . Dec. 1926 . . 25c
No. 117, Simple Electrolytic B-Eliminator . . . . . Feb. 1927 . . 25c
No. 123, Economy-Nine Superheterodyne . . . . . Nov. 1927 . . 50c
No. 126, Homemade A-Battery and Charger . . . . . Jan. 1928 . . 25c
No. 130, One-Tube Short-Wave Adapter . . . . . Mar. 1928 . . 25c
No. 131, Five-Tube All-Electric Receiver . . . . . Apr. 1928 . . 25c
No. 134, Edison Type B-Battery . . July 1928 . . 25c
No. 135, Screen-Grid Browning-Drake Receiver . . . Sept. 1928 . . 25c
No. 138, Screen-Grid Perfect-Tone Six Receiver . . . . . Nov. 1928 . . 25c
No. 139, Simple Television Receiver . . . . . Dec. 1928 . . 25c
No. 140, Power Amplifier and B-Supply for Television Jan. 1929 . . 25c
No. 141, Hammarlund-Roberts Hi-Q 29 Junior A.C. Receiver . . . . . Feb. 1929 . . 25c
No. 142, Two-Tube Screen-Grid Short-Wave Adapter Mar. 1929 . . 25c
No. 143, Four-Tube Screen-Grid Receiver . . . . . May 1929 . . 25c

AMATEUR MECHANICS



Make a Filipino "Yo-Yo"

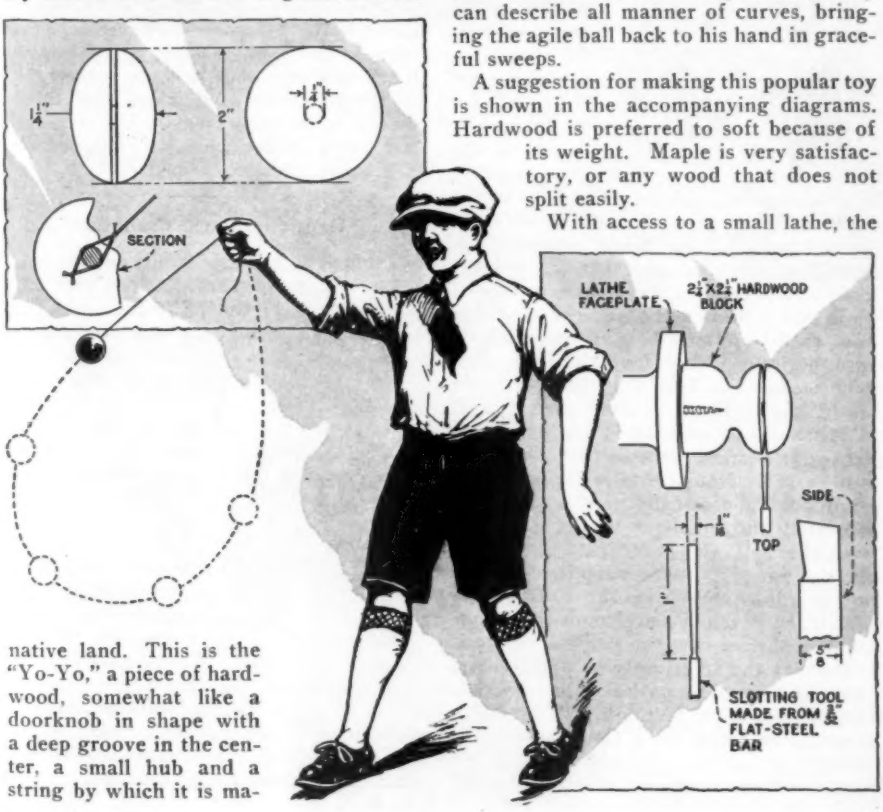
By HI SIBLEY

WITH the sole object of amusing himself, a Filipino boy of Santa Barbara, Calif., innocently started a fad that has swept the Pacific coast and is spreading fast to the rest of the country.

The Manila youth had merely revived a toy that is said to have originated in his native land. This is the "Yo-Yo," a piece of hardwood, somewhat like a doorknob in shape with a deep groove in the center, a small hub and a string by which it is manipulated. A loop in the string is slipped over the middle finger of the right hand, the cord is wound around the hub and with a deft outward thrust the Yo-Yo is released. When it has reached the end of the cord, the whirling motion rewinds it back to the hand. With experience, a boy can describe all manner of curves, bringing the agile ball back to his hand in graceful sweeps.

A suggestion for making this popular toy is shown in the accompanying diagrams. Hardwood is preferred to soft because of its weight. Maple is very satisfactory, or any wood that does not split easily.

With access to a small lathe, the



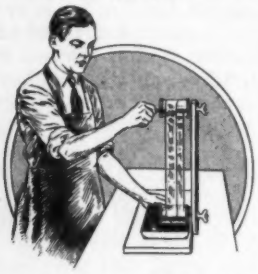
construction is simple. Screw a block of wood, 2¼ in. square and about 2½ in. long, to the lathe faceplate. Turn down roughly to the shape required and groove with a special cutting-off tool, made up by grinding or filing a flat steel bar to the dimensions given. Sandpaper the exterior as well as the slot before cutting off the Yo-Yo completely. Be sure that the groove is exactly in the center; otherwise the toy will wobble and perform erratically. A coat of stain and varnish makes a very neat job. Some of the youngsters have very elaborate Yo-Yos, beautifully inlaid with various woods.

The conventional Yo-Yo string has only two strands, which are divided and tied loosely over the hub, as shown in the section. If tied tightly the toy will have a tendency to jerk when it reaches the end of the string.

Any fairly hard string will do, and performance will be improved by rubbing the string across paraffin or candle wax.

Tin-Can Developer for the Darkroom

Developing films can be made easy by using a developer like that shown in the drawing. It is made of two tin cans, about 6 in. long and 3 in. in diameter, and four tin disks, 4 in. in diameter. First the covers are soldered to the cans, making a smooth joint, and then the disks to the end of the cans so that two spools are formed with a ½-in. flange around them. Punch a hole through the disks and the ends of the cans, in the center, to receive ⅛-in. stove bolts and allow the spools to turn easily. The spools are mounted on a support consisting of a 12 by 12 by 2-in. base to which a 1 by 1 by 30-in. wooden upright is nailed or screwed as indicated. A ⅛-in. slot, 28 in. long, is cut in the center of the vertical piece so that the spools can be set various distances apart to accommodate films of different lengths. In mounting the spools, a washer is slipped over the bolt, the latter passed through the slot and the assembly held by a wing-nut as shown. In use, the ends of the film to be developed are pinned together and it is slipped over the spools. The tray containing the solution is set on the base, the lower spool is pushed down so that the film dips in the solution, and the upper spool is adjusted until the film will be fairly taut. A pin soldered to the upper spool facilitates turning of the film. Of course, the emulsion side should be on the outside.—G. Everett Van Horn, Milton, Wisconsin.

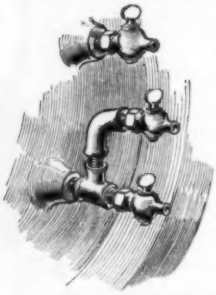


Rubber Tires for Farm Machinery

The hardest wear on wheeled farm implements occurs when they are hauled over country roads. Many of the wheels are nearly the same diameter as truck wheels, and it is possible to get second-hand solid tires that have done their duty in truck service, and which will fit the wheels of the implements. The latter will last much longer when so equipped.—K. E. Corliss, Langley, Wash.

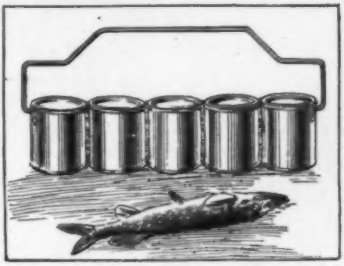
Gauge for Ford Crankcase

I found it rather difficult to determine when the oil level in my Ford crankcase was halfway between the top and lower petcocks. The difficulty was overcome by removing the lower petcock and installing a tee as shown in the illustration, the petcock being attached to the tee. Into the side opening of the tee a short nipple was screwed, and an elbow, another short nipple and a petcock were then attached as indicated. To make the drawing clearer, the petcocks are shown vertical, although when they are installed the handles should be horizontal, to make it convenient to open them with a long-handled wrench.—Arnold Fuog, Chicago.



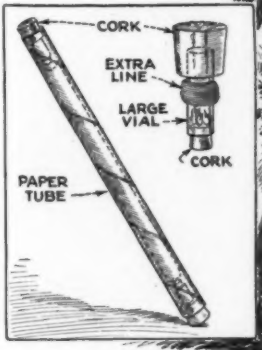
Practical Kinks for the Fisherman

A Screwhook and Eye Will Hold Your Poles—a Kink Which Is Well Worth While When the Fish Are Biting Fast



Handy Fishing Kit Made by Soldering Together Several Tin Cans; Left, Rigging Up the Set Rod to Strike the Fish—a Good Bite Makes It Spring

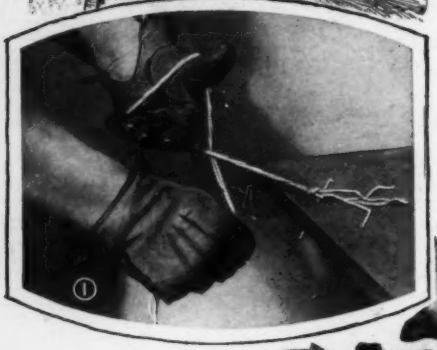
Runway with Screened Bottom and Covered Top Keeps the Fish Alive Where You Can Get at Them



Mailing Tube, Varnished, Forms Case for Sectional Rod, While Vials on End Corks Hold Sinkers, Hooks and Line

Great Sport

by Sam Brown



LIKE a snake coiled—sinuously twisting its way to the target with a sibilant swoop—that's the long whip. Believe it or no, there's real sport in one of these twelve-footers, if for no other reason than to hear the pistollike report which comes when the fleecy tip comes to a sudden stop in mid-air; if for no other reason than to be able to tie a neat knot in its corded length; if for no other reason than the pure joy which comes of making a bull's-eye on a 5-in. target.

Sure! Let's go! Step No. 1 consists in measuring off four 60-ft. lengths of 3/32-in. thick cord. Now, considering these four combined strings as one light piece of rope, fasten one end to a solid support and then chain-stitch the four strands for a distance of 20 in. If you are unfamiliar with chain-stitching, study Fig. 1, which shows the four strands being held for the initial operation. Holding the strands in this position, reach through with the left hand and grasp the standing part of the rope at the point A. Pull it through the loop, and then pull the strings marked A and B in Fig. 2 back and forth a few times until the stitch is jammed solid, as shown.

That's the whole operation: Reach through with the left hand and grasp the standing part; then pull the stitch tight by alternating pulls on the loop and the standing part of the rope.

As mentioned before, the chain stitch should be continued for a distance of 20 in., using the four strands. Wear a pair of gloves. This is pretty rough business!

At the completion of the twenty inches, have an assistant

Figs. 1, 2 and 3 Illustrate the First Three Steps in the Preparation of a Twelve-Footer—the Long Whip with Which Some of the Tricks Described Are to Be Performed

with a Whip

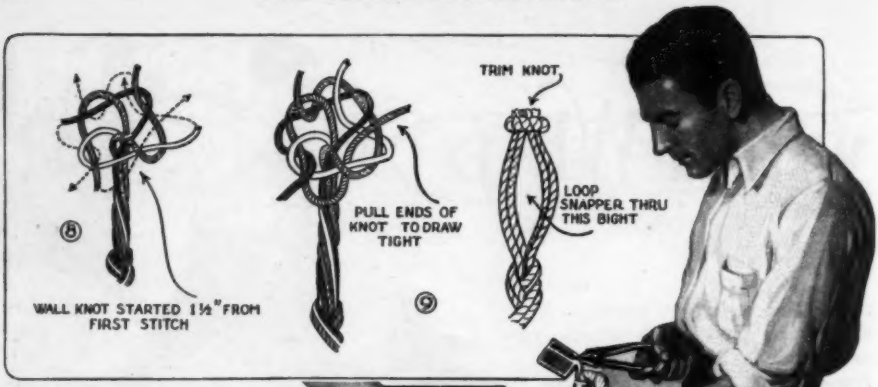
tie a fifth string in place, a little above the final stitch which you have made, as shown in Fig. 3. This fifth string should, of course, be of a length to reach to the end of the four-strand piece. After tying, work the fifth string in with the four-strand piece, as shown in Fig. 4, and continue working with five strands for a distance of 6 in.; then add a sixth string and work the six strands for a distance of 6 in., continuing to build up every 6 in. in this fashion until at the end of your whip you will be working with a 24-strand rope. And sore hands!

Anyhow, turn or whittle out a handle from 1½-in. round stock, as shown in Fig. 5, and jam the large end of the whip down into the hole cut in one end. Now, drive a few small brads into the handle, as shown in Fig. 6, and then pour melted rosin into the hole to hold the end of the whip firmly in place, as shown in Fig. 7.

Working the Fifth Strand In with the Four-Stranded Piece; Layout of the Handle and the Manner in Which It Is Fastened to the Lash; (See Also Fig. 7 on the Following Page)

So far, so good! Go back over the whip and unfasten the added strings. Tie one or two single knots in each of these strings to prevent them from unraveling, and then pat them down so that they will lie snugly against the side of the whip. Down at the extreme tip, you will find that you have eight or ten inches of unbraided cord consisting of the original four strands. Tie these four strings together in a tucked wall knot, about 1½ in. from the first stitch, as shown in Figs. 8 and 9. Loop a snapper, consisting of two 12-in. lengths of frayed cord, doubled, through the bight at the end of the whip, as shown in Fig. 10.

That completes the whip. It may suit



you to stain or paint the handle and that is quite all right. Also you may find it necessary to give the whip a dip in hot paraffin in order to give it additional stiffness.

Now for some action! How about the "comeback?" Let the whip trail behind you. Take a walking step forward, then lash out with an outward and overhand sweep of your arm at a round stick which you have placed horizontally on top of two boxes. Zzz-z-z! Snakelike in its action, the light tip wraps two or three times around the length of the stick, as shown in the close-up, Fig. 11. At the proper moment you should jerk your whipping arm high over your head, as in Fig. 12, so that the stick is lifted from its perch and sent hurtling back to you where it should be deftly caught in your left hand.

Of course, it's not quite so simple as the proverbial "falling off a log"; it takes some practice. You must learn, first of all, how to control the whip so that it will go in the direction you desire. Second, you must leave sufficient slack to allow the whip to wrap itself around the target. Third, you must know when and with what force to pull so that the target will come sailing back at a catchable speed and at a catchable angle.

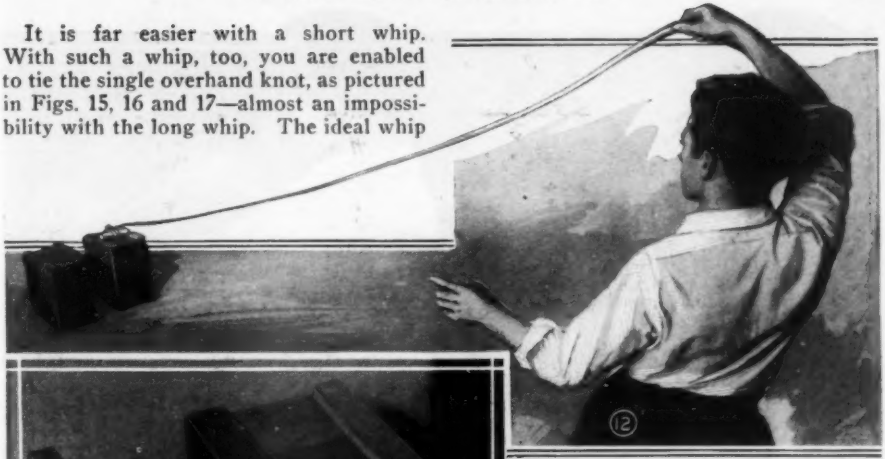
It all comes with practice.

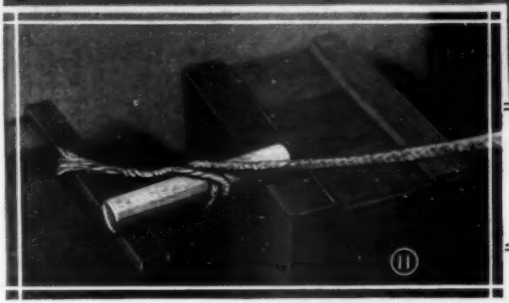
After mastering the stick comeback, try the same thing with a large rubber ball mounted on a pedestal. This is by no means so easy! Whereas, in the stick, you had a considerable latitude as to where to strike, with the ball there is only one spot, and that is directly around the center, where the whip tip can curl with sufficient retaining power to allow of the snap back.

For something easier, try cracking—it is the best and easiest thing possible with a whip. There are numerous ways of cracking a whip, but perhaps the simplest is the one illustrated in Fig. 14. Take the first position, as shown, with the whip coiled loosely behind you; then, step forward, raising the whip handle high over your head, and then snap downward. A pistollike report is the result. With this long whip it is not likely that success will greet your very first efforts; a little knack is required in handling the whip so that the full 12 ft. will flail out and snap back without some part of the whip striking another part.

After mastering the single crack, practice until you can crack the whip ten or twelve times in succession by swinging your whip hand alternately right and left in front of your body.

It is far easier with a short whip. With such a whip, too, you are enabled to tie the single overhand knot, as pictured in Figs. 15, 16 and 17—almost an impossibility with the long whip. The ideal whip





Catching Stick with Long Whip; Fig. 14, Preliminary Steps in Cracking It, and, Fig. 15, Six-Footer or Short Whip for Tying Single Knot (See Figs. 16 and 17, Page 143)

for the tying of this knot is a six-footer, thoroughly rubbed with beeswax or having a fine length of steel wire inserted throughout its length in order to give it the rigidity required. The actual tying of the knot is simplicity itself. Figure 15 shows the first position: Whip held in right hand, right hand palm upward. The second position calls for the turning of the whip hand so that the palm is downward, thus bringing the whip around so as to form a large bight, as shown. From Fig. 16 it is an easy matter to swing the whipping hand around with a short clock-

Figs. 18, 19 and 20, Preparing the Long Whip for Tying Several Knots, and, Fig. 21, the Trick Done

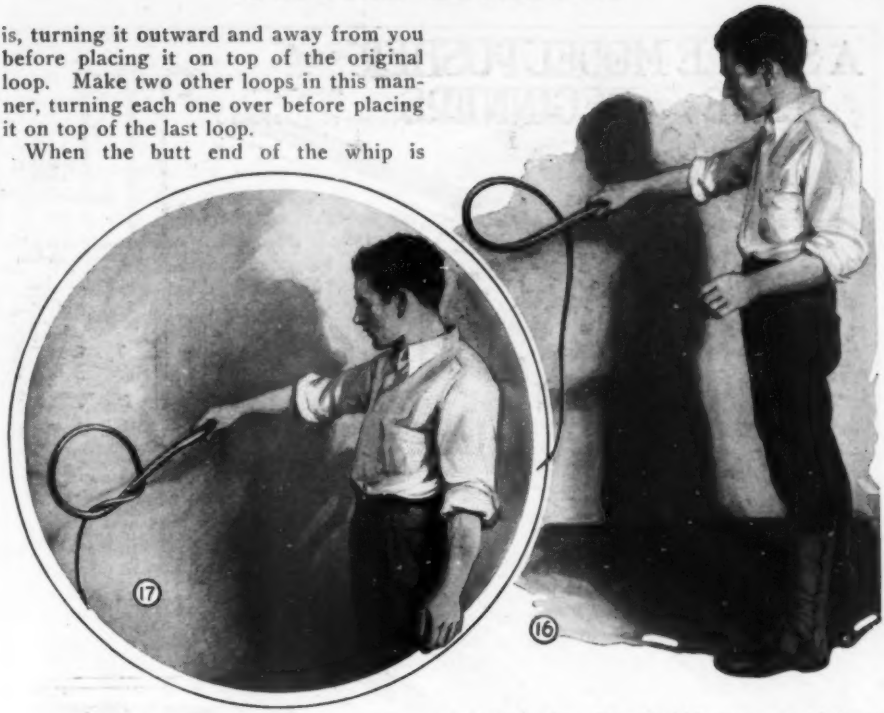
wise motion so that the tip of the whip, which should be weighted, will swing through the bight and form the knot, as shown in Fig. 17. The knot can be left in this loose formation, or, if desired, it can be tightened by swinging the whipping hand backward with a short snap. A stiff whip is absolutely essential. Of course, such knots as the "Pretzel" and the "Figure-8" can be performed with the soft whip, the procedure being exactly the same as that used in tying these knots in a lariat.

A clever knotting effect with the long whip consists in the tying of three separate knots in as many snakelike lashes. Here's the how:

Holding the tip end of the whip in your hand, you take the standing part of the whip and form a loop which you hold in your left hand, as in Fig. 18. Notice that the standing part of the rope passes under the tip. Figure 19 illustrates the second position—the formation of a second loop with the standing part of the whip again being on the underside. The third step consists in turning this second loop over and placing it over the first loop, as shown in Fig. 20. That's the whole trick—taking that second loop and turning it over; that

is, turning it outward and away from you before placing it on top of the original loop. Make two other loops in this manner, turning each one over before placing it on top of the last loop.

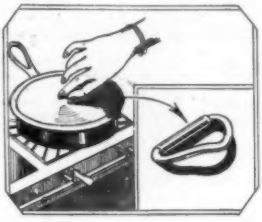
When the butt end of the whip is reached, casually take the handle and swing it through the entire series of four loops. That's all there is to it! Slashing out with three or four vigorous sweeps, you will find that the whip becomes neatly tied in three individual knots, as shown in Fig. 21. Of course, the initial moves must be made rapidly and casually; merely the natural way in which the whip is coiled up when not in actual use. Even though the effect is 100-per-cent trickery, it can be made to appear entirely a matter of skill if a little showmanship is used.



So much for the whip. Naturally enough, this short article does not, by any means, exhaust its possibilities—you need only have the whip in your hands for a short half hour to fully realize the many delightful variations of sending its twelve feet of corded length swirling through the air.

Improving Handles on Pan Covers

Ring handles on the lids of cooking vessels can be altered slightly to make it easier to pick up the lids. Take a pair of pliers and bend the ring as shown in the detail. After that the ring will not lie flat on the surface of the cover and, therefore, can readily be raised to a vertical position with the fingers without touching the cover.

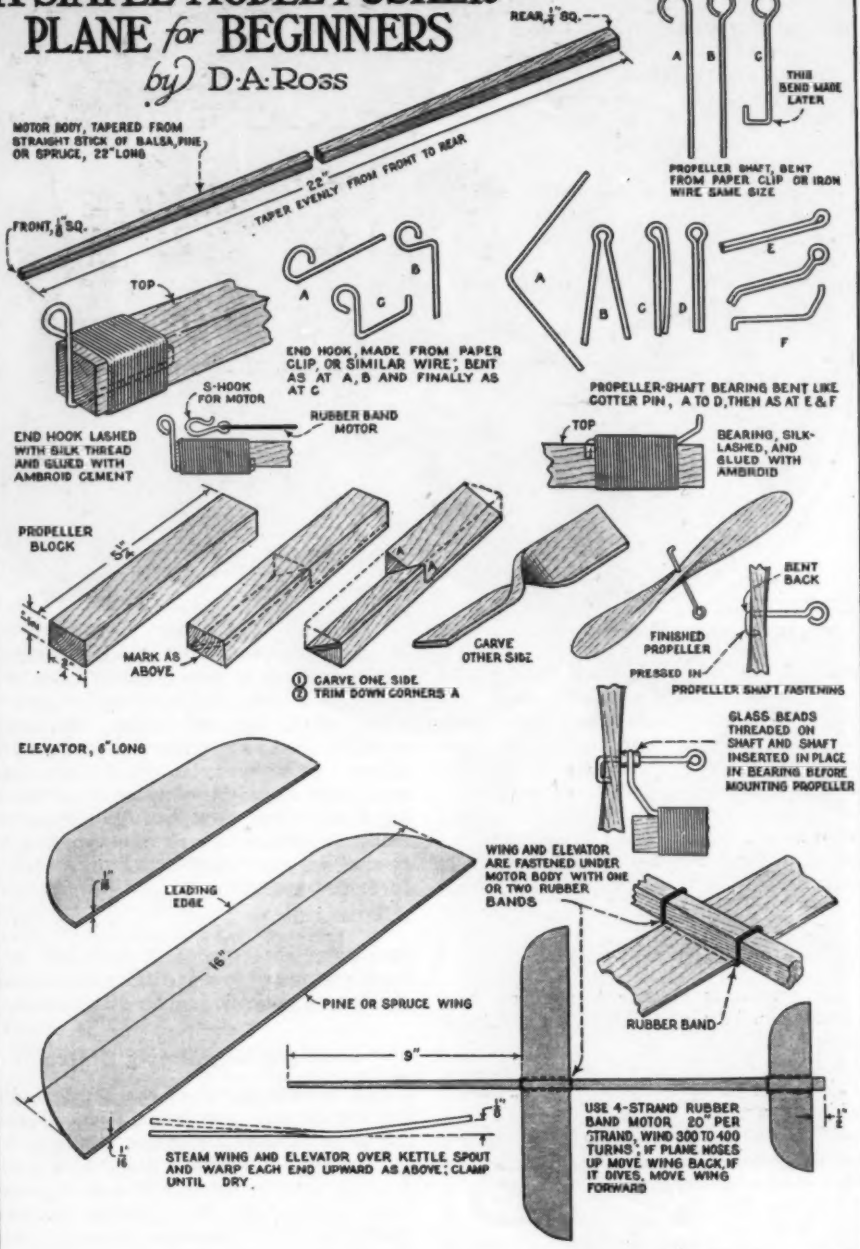


Photographing Moving Objects

The average speed of the shutter of a movie camera is one-thirtieth second, and therefore exposures must be regulated by the opening of the lens diaphragm only. As this shutter speed will not stop the motion of fast objects, a greater distance should be placed between them and the camera in order to get good results.

A SIMPLE MODEL "PUSHER" PLANE for BEGINNERS

by D·A·Ross


REAR, ¼" SQ.
MOTOR BODY, TAPERED FROM STRAIGHT STICK OF BALSA, PINE OR SPRUCE, 22" LONG
22"
TAPER EVENLY FROM FRONT TO REAR
FRONT, ⅛" SQ.
A
B
C
THIS BEND MADE LATER
PROPELLER SHAFT, BENT FROM PAPER CLIP OR IRON WIRE SAME SIZE
TOP
END HOOK, MADE FROM PAPER CLIP, OR SIMILAR WIRE; BENT AS AT A, B AND FINALLY AS AT C
S-HOOK FOR MOTOR
RUBBER BAND MOTOR
END HOOK LASHED WITH SILK THREAD AND GLUED WITH AMBROID CEMENT
D
E
F
PROPELLER-SHAFT BEARING BENT LIKE COTTER PIN, A TO D, THEN AS AT E & F
TOP
BEARING, SILK-LASHED, AND GLUED WITH AMBROID
PROPELLER BLOCK
MARK AS ABOVE
CARVE ONE SIDE
TRIM DOWN CORNERS A
CARVE OTHER SIDE
FINISHED PROPELLER
BENT BACK
PRESSED IN
PROPELLER SHAFT FASTENING
GLASS BEADS THREADED ON SHAFT AND SHAFT INSERTED IN PLACE IN BEARING BEFORE MOUNTING PROPELLER
ELEVATOR, 6" LONG
LEADING EDGE
16"
PINE OR SPRUCE WING
WING AND ELEVATOR ARE FASTENED UNDER MOTOR BODY WITH ONE OR TWO RUBBER BANDS
RUBBER BAND
9"
STEAM WING AND ELEVATOR OVER KETTLE SPOUT AND WARP EACH END UPWARD AS ABOVE; CLAMP UNTIL DRY.
USE 4-STRAND RUBBER BAND MOTOR 20" PER STRAND, WIND 300 TO 400 TURNS; IF PLANE NOSES UP MOVE WING BACK, IF IT DIVES, MOVE WING FORWARD

Water for Potted Plants

Steam or hot-water heated homes and apartments are much drier than the old-fashioned kitchen where the hot-water reservoir was always steaming. Although radiator water pans are available to provide humidity, they are seldom used, and filling them with water is often neglected. House plants suffer considerably from this condition, as moisture is evaporated from their leaves very quickly, and the soil in which they are set soon dries out. There are two methods of overcoming this trouble, and both of them should be applied. The first and obvious thing to do is to give the plants plenty of water. The soil about their roots should, however, not be made muddy, or it will puddle and cake when it dries. It should be kept moist by frequent waterings in small quantities. The air in the room should also be kept much more humid than it is ordinarily, not only for the plants' benefit but also for the benefit of the inmates. It has been found a good idea to use a small hand spray for applying water to plants. This, besides supplying water, keeps the leaves free from dust.

Novel Fountain and Pool for the Lawn Walk

Here is a novel fountain and pool set on a wide lawn walk of a Texas residence. It is 9 ft. long, 4 ft. high and 3 ft. wide. The depth of the pool is 20 in. below the walk level and the sides project 8 in. above the walk. Concrete and cobble stones are used in its construction as shown, and the ends are shaped to form seats. A small spray in the center forms the fountain and an overflow pipe is installed to drain off the water a few inches below the edge. It serves as a bird bath and pool for goldfish.

Ornamental Pool on Wide Lawn Walk Is Made of Cobble Stones and Concrete

Asbestos Hood over the Camp Stove in the Tent Carries Off the Fumes

Ventilation for Camp Stove in Tent

Although the use of a camp stove in a tent should be avoided because the burning consumes the oxygen, making the atmosphere stuffy and possibly giving off carbon monoxide, it is frequently necessary during cold and rainy weather to do so. In such cases adequate ventilation is necessary and a hood, made of asbestos cloth, should be provided to carry off the fumes. At a point in the roof directly above the stove, a round hole is cut, and a canvas cylinder is sewed to the edge of the hole, as shown. A canvas flap, adjustable by means of cords passing through eyelets, is made to fit over the opening in the roof to prevent the entrance of rain when the stove is not in use. The hood, made to the shape shown in the drawing, is sewed to the lower end of the canvas cylinder. Removable rods in the hem of the hood keep the bottom extended and square.

Swinging Baby Crib Made from Discarded Rocking-Horse

We had an old rocking-horse, the framework and swinging members of which were intact,

Swinging Baby Crib Made by Attaching Orange Box to Frame of Old Rocking-Horse

while the horse itself was broken. The latter was removed and an orange crate substituted. The spacing between the points where the swinging members are fastened to the underside of the crate is the same as their spacing on the horse formerly used. This gives the best balance and permits a maximum swing. To help the child in starting the rocking, two strips of wood are screwed to the front of the frame and a rope stretched between them. By leaning forward and grasping the rope, which a child seems to do instinctively, the box is put in motion. A wooden strip or rod could be used instead of a rope, but the latter is safer.—Myron L. Harmon, Chicago.

Famous Problem Solved at Last

How to dispose of old razor blades, which are a constant source of danger, is a problem that bothers most of us at one time or another. However, here is a good solution. Get a small screw-cover glass jar. Wash it thoroughly and dip the top in melted paraffin to prevent the chemical, which the jar is to contain, from "creeping" up to the top. Get a pound of ordinary copper sulphate, or blue vitriol. Fill the jar with water nearly to the ring of paraffin and add a few more crystals of copper sulphate than the water will dissolve. Cut a piece of blotting paper to fit tightly in the screw cover and dip it into the melted paraffin. While still hot, place it in the cover. After the paraffin has cooled, put the cover on the flat end of a block and cut a slit through it with a heavy, sharp knife or chisel. This slit should be just large enough to allow the type of blade you use to slide through. Cut from the outside so that the rough edges will be on the inside. Thin blades dropped into this solution will completely dissolve in 48 hours. Thicker ones will take a correspondingly longer time. When the solution is no longer active, throw it away and prepare some more. It is no more dangerous than the average medicine or disinfectant, and is harmless unless taken internally.—Herbert M. Mapes, Albany, N. Y.

Shield for Strawberries and Tomatoes

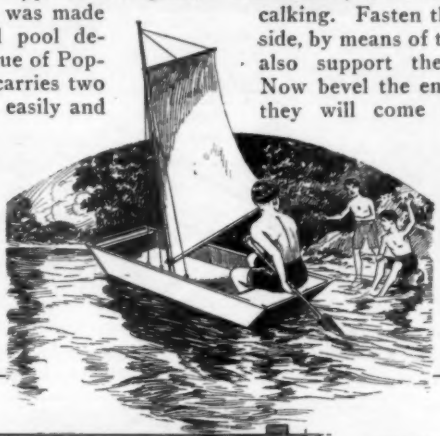
Every year a great number of strawberries and tomatoes rot before they are thoroughly ripe because they lie on wet ground. To prevent this, it is a simple matter to provide a wooden shield as shown in the drawing, a large hole being cut in the center of the shield to admit the stem of the plant. The strawberries and tomatoes will not come in contact with the moist earth but will lie on the shield. At the close of the season, all the shields are stored.

¶Sticky fly paper can be removed by sponging with turpentine.

A Boat for the Swimming Pool

By HI SIBLEY

THIS small boat is designed for the boy who does not care to spend much time or money for something to paddle about in. No shipbuilding experience is required to construct this type. The original, shown in the photos, was made for use in the small pool described in the June issue of Popular Mechanics, and carries two average ten-year-olds easily and comfortably.

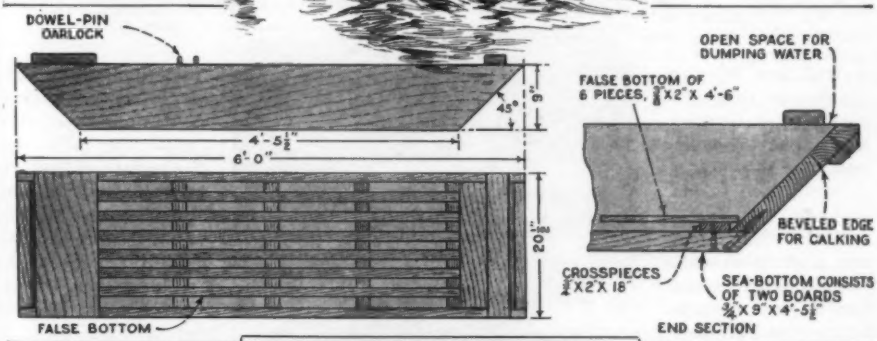


If you have plenty of waterway, however, a 7-ft. model is preferred to this 6-ft. design. Unless you have some first-class lumber on hand, you will have to buy it from a mill. They will advise you the best wood available in your locality.

For the 6-ft. model, without extras, you will need 28 linear feet of ¾ by 9-in. (net) lumber, finished on all sides. The complete bill of material appears at the bottom of page 148.

It is possible to use nails in putting the boat together, but you will find screws much more satisfactory, especially in keeping it watertight under rough usage.

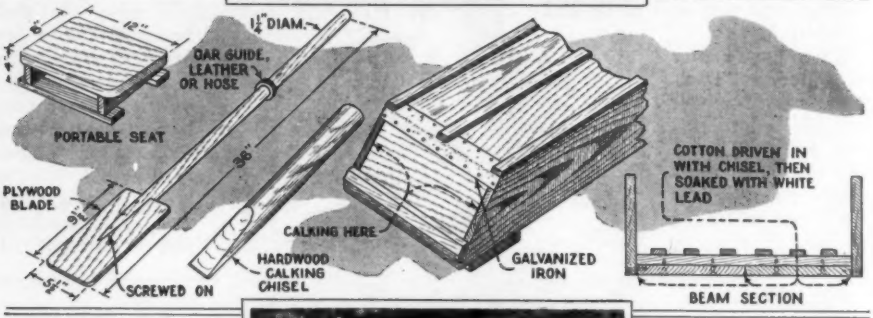
First bevel the edges slightly on the bottom boards, to make space for the cotton calking. Fasten them together, side by side, by means of the crosspieces, which also support the false-bottom slats. Now bevel the ends at a 45° angle, so they will come flush with the end boards. The sides are next screwed to the bottom, the ends of the former first having been sawed off at a 45° angle. Make all screw holes with a hand drill, and take care you do not split the bottom edge of side boards before you install the endpieces to brace them. The end cleats strengthen the entire boat and also serve as bumpers.



Turn the boat upside down and drive in cotton with a calking chisel, as shown. This chisel should not taper to a thin edge, as it will tend to split

and catch in the cotton, pulling it out when you withdraw the chisel. The cotton should be well packed, but not quite flush with the surface of the wood. See that every seam and corner is treated thus. Next apply white lead, sloshing

If you wish to use oars, a pair can be simply made as shown in drawing. These are short enough to use as paddles also. Plywood is selected for the blade because it is not liable to split. However, smooth the edges well with



it well into all the cracks, so that the cotton becomes thoroughly soaked, and give the boat a priming coat inside and out.

When this is dry, nail a strip of galvanized sheet, about 4 in. wide, over each bottom end corner, as shown. This is to prevent scuffing when beaching the boat, and is also added reinforcement. Nail three skids on the bottom over the seams. These will protect the bottom as well as the seams.

Your boat is now ready for the final coat of paint, the color depending on your taste, or whatever you may have on hand. The original was painted a chocolate-brown with green trimmings.

The last job is to lay the false-bottom slats, which add to the appearance if varnished in natural wood. A coat of spar varnish over the entire boat will preserve its appearance.

file and sandpaper, and soak thoroughly with paint so that moisture will not penetrate and loosen the wood. A low portable seat is preferable to one fastened to the gunwales, since it can be moved to the most convenient position and brings the center of gravity low in the boat.

For general purposes, this little boat meets all demands and will survive rough

MATERIAL LIST

2 pieces, ¾ by 9 in. by 4 ft. 6 in., bottom.
2 pieces, ¾ by 9 in. by 6 ft., sides.
2 pieces, ¾ by 9 by 20½ in., ends.
2 pieces, ¾ by 4 by 20½ in., ends.
1 piece, ¾ by 9 by 20½ in., end seat.
3 pieces, ¾ by 3 by 20½ in., end cleats.
5 pieces, ¾ by 2 by 18 in., false-bottom cross-pieces.
6 pieces, ⅜ by 2 in. by 4 ft. 6 in., false-bottom slats. (Building lath was used in original.)
9 doz. wood screws, 3-16 by 1½ in.

handling. With the addition of a wood keel, about 6 in. deep, it could be rigged up for sailing, having a short mast well forward and a square or leg-of-mutton sail. The paddle could be used as a rudder.

When Out of Gas Try This Kink

Only seldom does an auto run so utterly dry of gasoline that there isn't enough left to carry it one, two or even three miles farther. To make use of the last drop of gasoline in the tank, it is first necessary to push the car to the crown of the road or to jack up the lowest wheel so that the tank will be level. Then remove the drain plug of the tank, allowing a sufficient quantity of gasoline to be drained out. The reason this can be done is that the feed pipe carrying the gasoline to the vacuum tank is usually located just a little higher than the drain plug on the tank and therefore does not carry off all the gas. Gasoline obtained in this way should be strained through a cloth and then transferred to the vacuum tank or, if the amount is very small, directly to the float chamber of the carburetor.—George Alan Strader, Astoria, N. Y.

How to Brighten Gilt Articles

A friend of mine is the owner of a large collection of paintings, many of which have gilt frames. He finds that the gilt tarnishes to such an extent that the frames have to be restored about once a year. Repainting would, of course, solve the problem, but the gilt can also be restored in the following way: Take enough flour of sulphur to make a golden tinge in about 1½ pt. of water, and boil in this four or five bruised onions. The liquid is strained and ready for use as soon as it cools. Simply apply the liquid to the gilt surface and allow to dry.—V. Johnson, Spokane, Wash.

Tubular Focusing Cloth Fitted with Rubber Bands, to Hold It in Place

Auto Skid Chains, Packed in Oil-Soaked Sawdust in Oilcan, Are Safe from Rust

Stowing Away the Skid Chains

An old oilcan, with one side cut away and the edges turned back to prevent cutting the hands, makes a good receptacle for storing the auto skid chains. It is filled with oil-soaked sawdust which keeps the chains free from rust. Old crankcase oil can be used. The handle of the can is left on, to facilitate lifting and moving.

Improved Focusing Cloth

Besides admitting reflected light from the ground, a focusing cloth of the ordinary kind is very inconvenient to handle in the wind. I improved my cloth by sewing two edges together and inclosing rubbber bands in ends. One end is snapped over the back of the camera and the other end over the photographer's head, and in this way the cloth is much handier and more efficient than it was before.—Charles M. Doten, Plymouth, Massachusetts.

Ice Man Uses Canvas Bag to Prevent Dripping on the Floor

Ice-Delivery Bag

A considerate ice man provided himself with a heavy canvas bag with open ends, as shown in the illustration. It is similar to an old-fashioned carpet bag. By using it for delivering ice in houses and apartments, not a drop of water will get on the floor, a feature which especially appeals to the housewife.—Orin Crooker, Kansas City, Mo.

Storing Moisture for Flowerbeds

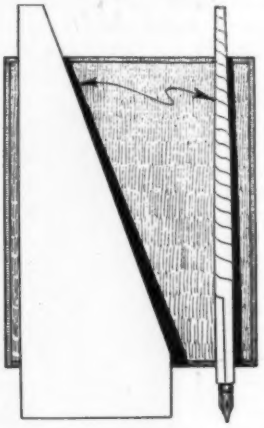
The necessity of constantly watering flowerbeds during the dry spells of summer, can be avoided by the following method: Prepare your flowerbeds by digging deeply and removing the earth. Into this space pack empty tin cans, useless jars, wide-mouthed bottles, etc., top upward. If your own supply runs short, your neighbors will gladly donate their accumulations. Place a layer of straw on the cans to prevent loose dirt from filling them. Fill the remaining space with rich earth. If the beds are to be seed-sown, about 3 in. of dirt should cover the cans. If large-rooted plants are set out, a deeper layer is, of course, needed. Keep the soil well troweled at all times to allow a free course for rain water to accumulate. There will be constant moisture at the roots of the plants and they will flourish during the dryest season.

Marking Milk and Cream Cans

Many dairy farmers have their initials in brass letters soldered to the cans. The trouble is that the letters often come loose and are torn off. A better and cheaper method of marking is as follows: Take a pencil and outline the letters to be used. With a small stick or toothpick, having a wad of cotton wrapped tightly around the end, apply a small quantity of soldering fluid or flux over the letters, taking care to keep inside of the lines. Then with a hot soldering iron melt some solder over the letters. Of course, this must be done accurately so that the outlines will not be ragged. Such letters are slightly raised above the surface of the can and they will never come off. It is also well to mark the covers so that they will not be used interchangeably on a number of cans. Put a single drop of solder on the cover near the side and one drop on the can. On another can and its cover, drop two driblets of solder, and so on.—Cora Hamilton, Binghamton, N. Y.

Quickly Made Pen Holder

When you are in need of a pen holder and cannot find one, get a sheet of paper, cut it to the shape shown in the left-hand detail and roll it tight to form the holder. To prevent it from unrolling, apply a small quantity of glue to the edge of the paper. Insert the pen in the end and the pen holder is ready for use. You will find that it answers the purpose quite well.—C. R. Jones, Los Angeles, Calif.



Wood Joints for the Amateur

PART VI

FIGURE 29 shows how heavy rails, at the left, and wide rails, at the right, are tenoned. Fig. 30 shows the difference in handling between an outside rail and an inside one in a frame. In the outer rail, the width, W, of the tenon must be reduced to leave some wood in the stile, above the mortise, and consequently the tenon is haunched to reduce lipping. In the inner rail, the width, W, of the tenon is made the full width of the rail. Fig. 31 shows how a segmental rail, or one of other shape, is tenoned into the stile, the tenon being cut on the lower part of the rail, and the haunch carried up to the top.

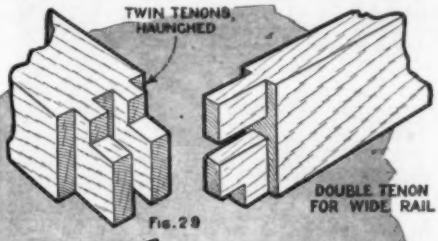


Fig. 29

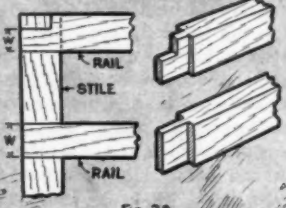


Fig. 30

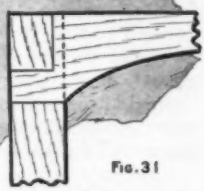


Fig. 31

TENON ON SEGMENTAL RAIL

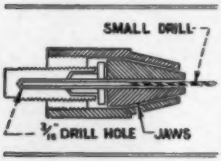
Mortise-and-tenon joints, for further security, are often pinned with a hardwood dowel, as shown at the left, Fig. 32, and in order to insure that the shoulders on the tenon will be drawn up tight against the stile when the pin is driven in, the joint is "drawbored." To do this, first drill the hole for the pin through the mortised member. Then put the tenon in the mortise, insert the drill through the hole already bored, and, with its point, mark the center of the hole in the tenon. Withdraw the tenon, shift the center of the hole slightly toward the shoulder of the tenon, and drill. This is shown in the lower sketch, Fig. 32, where A is the original center mark and B the mark made for the drilling. In the illustration, the distance between the marks is, of course, greatly exaggerated; in practice, it is barely perceptible; if the amount of "draw" is too great, there is danger of the pin breaking out the wood beyond the hole. The joint is now glued and assembled, a steel taper pin is driven through the holes to bring them in line, and then a slightly tapered hardwood pin driven in. When the glue has set, the pin is dressed down

Fig. 32

flush with the surface. The sections, Fig. 32, show the effect of drawboring, all exaggerated to make the idea plainer. An open-slot mortise and tenon (end bridle) may also be drawbored and pinned, but in this case it is necessary to draw the hole in the tenon in two directions, so as to force the tenon down hard to the bottom of the slot, in addition to drawing the shoulders against the stile.

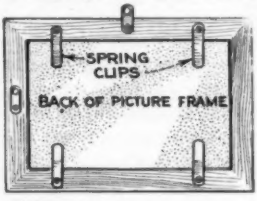
Preventing Small Drills from Bending

The tendency of small drills to bend when used in hand drills can readily be overcome by the method shown in the drawing. Take the chuck apart and drill a hole through the plate that pushes the jaws out and also in the shank. A 3/16-in. drill can be used for this purpose. The hole should be deep enough so that it will take the full length of a 1/16-in. drill. This also makes an excellent depth gauge as the drill can be slipped down to any desired depth, and when the chuck jaws come in contact with the work, the hole is the right depth.



Picture Frame with Removable Back

It takes only a moment to exchange pictures in a frame having the removable back shown in the drawing. To make such a frame, get some thin spring brass and with a pair of shears cut pieces of the shape indicated and of a size most suitable for the frame on which they are to be used. Drill a hole at one end of each clip to permit attachment to the frame with a wood screw. The clips press against the back of the picture frame and thus hold it in place securely.—Wm. S. Davis, Orient, L. I., New York.



¶To prevent mosquitoes from crawling through a screen, rub it with a cloth soaked in kerosene.

Keeping Eave Troughs Clean

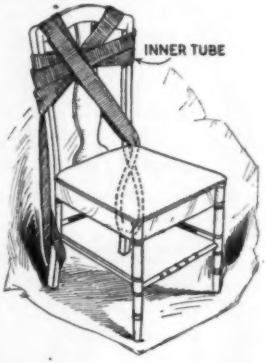
To prevent leaves from getting in the eave troughs and conductor pipes, it is a good idea to cover the open part of all the troughs with ¼-in. wire mesh. The mesh should be about 1 ft. wide, one edge being tacked to the roof with small staples, and the other bent over the trough. A heavy coat of roofing tar or paint applied to the staples, will prevent a possible leak in the roof.—W. E. Boyd, Visalia, Ky.

How to Handle a Heavy Truck Wheel

When removing a heavy truck wheel that is hard to handle get a smooth piece of plank and grease it. As soon as the wheel is ready to come off the axle, lower the jack until the wheel just touches the greased plank which is laid under it. Then pull the wheel slightly and it will slide off with very little effort on your part.

Old Inner Tubes Used for Clamping Furniture after Repair

Pressure on the wood while glue is setting, is the fundamental of good gluing. Special clamps are used for this purpose, but the average home mechanic who occasionally finds it necessary to glue a chair or other piece of furniture usually has none, and must, therefore, devise a substitute method. Old inner tubes have been found satisfactory for the purpose. A chair was accidentally overturned in the home and the back was broken, which made it necessary to make a glue repair. Several old inner tubes were stretched tightly over the broken parts to hold them in position, as shown in the drawing. They served the purpose of clamps and could be applied much more easily than the latter without risk of marring the varnished surface.



Using Lawn Clippings in Window Boxes

One of the disadvantages of window boxes is that mud often spatters up from them onto the window screens or on the window itself when it is raining. To prevent this, I picked up lawn clippings with which I covered the dirt in the boxes, fitting the clippings neatly around the base of the plants. The grass layer prevents spattering.—Mrs. A. K. Hinkley, Rowley, Massachusetts.

Convenient Holder for Hot Pots

Many housewives will find it convenient to have a hot-pot holder handy at the stove, as shown in the drawing, so that they will not soil a clean towel or other cloth when a pot boils over and it must be hastily removed from the fire. The illustrated holder is always in view in a position where it can readily be grasped when needed. Besides, it is counterbalanced so that it hangs out of the way but can still be pulled down to almost any position on or near the stove. Two screweyes, a small bag of sand or shot, weighing about ¼ or ½ lb., and a length of chalkline are all the parts necessary to make it. The screweyes are driven into the ceiling as indicated, the sand bag is tied to one end of the line, which is threaded through the screweyes and has the holder tied to the other end. The length of the line, of course, should be such that the holder is within reach when the sand bag rests on the floor.—Mrs. Alex Forsyth, Fallon, Nev.

This Counterbalanced Pot Holder Is Always at Hand When Needed

Homemade Screens for the Auto Windows Permit Ventilation and Keep Out Insects

Screen Windows for Closed Cars

Ventilation of closed cars can be readily accomplished by the use of screens of the type shown in the photo. The frames are made of wood having grooves to fit over the edge of the windows and tongues to fit into the window grooves. Fine-mesh screen is used to keep out mosquitoes and other insects. Each frame is hinged at the center so that it can be folded and stored away when not needed, and this construction also is necessary in order that the tongues on the sides may be slipped into the window grooves. After the screens have been inserted, the window is brought up tightly against them.—Clyde Purcell Scott, Los Angeles, Calif.

Chalk Removes Quicksilver from Gold Ring

When mercury is handled, one often forgets to remove his ring. When this happened to me recently, I was told to rub chalk on it. After two or three applications, each being rubbed in thoroughly, I wiped the ring clean with a soft cloth, and found that all traces of the mercury had disappeared.—Harry Burrell, Dover, New Jersey.

KITCHEN

By E.M.Love.

MANY housewives sigh for more cupboard space in the kitchen. Waste space under a gas range can be utilized to good advantage if a pots-and-pans cabinet is built to stand between the stove legs. This cabinet, as illustrated in Figs. 1 and 2, can be made of such cheap material as No. 2 white pine. The knots, if shellacked and puttied, will paint over well.

In gluing up for width, alternate the heart and sap sides of the boards to minimize warping. Rabbet the ends of the top, to take the sides, and rabbet the lower ends and back edges of the sides. The grain of the sides and the partition runs vertically, so that these parts will shrink with the top and bottom. Glue and nail all joints. When dry, round the arrises (edges) to a radius of ⅜ in.

The doors, if made of solid stock, must have cleats on their backs to prevent warping. Use no glue, and put the end screws through slots in the cleats, so that they can slide when the doors shrink. Fit with 1/16-in. clearance all around, and hang with 2 by 2-in. loose-pin butts.

Five-ply veneer stock, which neither shrinks nor warps, makes better doors, which require no cleats and can be fitted closer. Latch the doors with a ⅜-in. forg catch in the top of each. Add knobs at a convenient height, and ball casters.

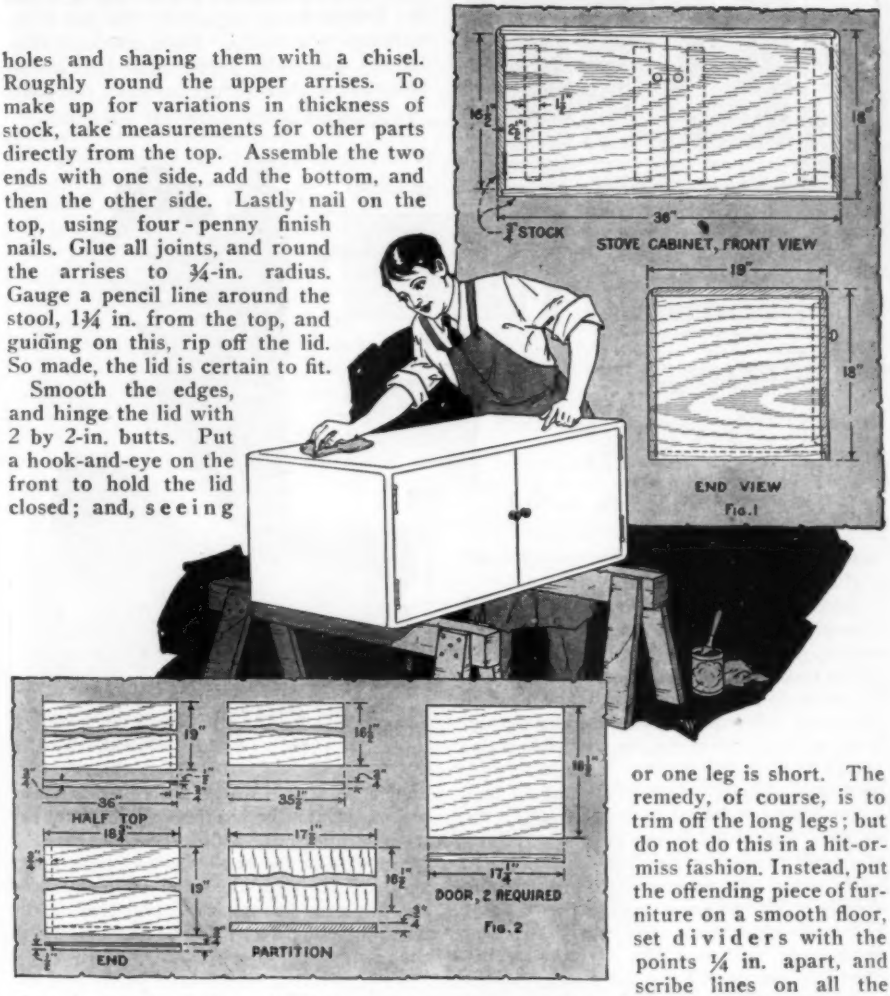
The housewife will find plenty of use for the footstool detailed in Fig. 3. Being in box form, it is handy to hold cloths and other odds and ends needed about the kitchen. The handholes in the top make it easy to pick up the stool.

Make the top first, boring out the hand-

MECHANICS

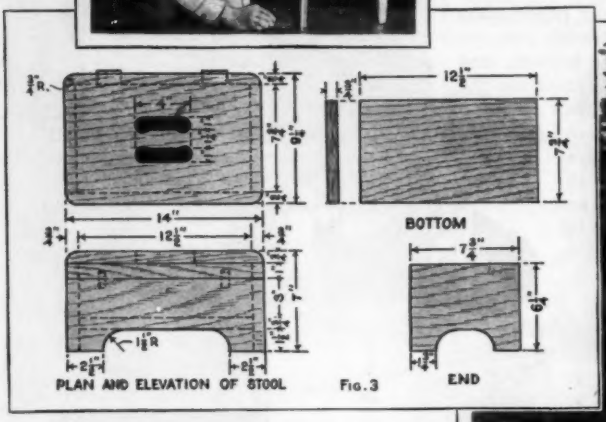
holes and shaping them with a chisel. Roughly round the upper arrises. To make up for variations in thickness of stock, take measurements for other parts directly from the top. Assemble the two ends with one side, add the bottom, and then the other side. Lastly nail on the top, using four-penny finish nails. Glue all joints, and round the arrises to ¾-in. radius. Gauge a pencil line around the stool, 1¾ in. from the top, and guiding on this, rip off the lid. So made, the lid is certain to fit.

Smooth the edges, and hinge the lid with 2 by 2-in. butts. Put a hook-and-eye on the front to hold the lid closed; and, seeing that the stool will be subjected to many hard knocks, glue a couple of dowel pins into the lock edge of the box, to fit into holes bored in the lid.

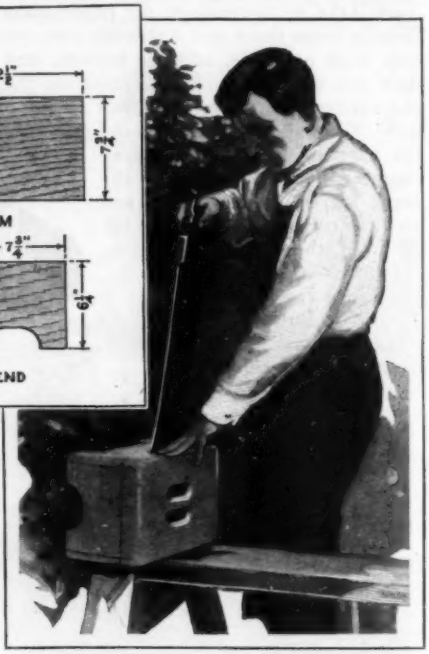


Rocking chairs are proper equipment for the living room, but not for the kitchen or breakfast room. And rocking tables! Sometimes they teeter because the floor is uneven, but generally one leg is long, or one leg is short. The remedy, of course, is to trim off the long legs; but do not do this in a hit-or-miss fashion. Instead, put the offending piece of furniture on a smooth floor, set dividers with the points ¼ in. apart, and scribe lines on all the legs, using the floor as a guide. Then cut off the legs to the lines, and they will all rest on the floor.

Kitchen tables with porcelain tops are comparatively expensive. Almost equally good are cheap unfinished tables with tops covered with a scrap of inlaid linoleum, cemented down, tacked around the edges with brads, and shellacked. The



PLAN AND ELEVATION OF STOOL Fig. 3



resulting surfaces are surprisingly fresh and attractive in appearance.

Such cheap tables are equipped with drawers that are very uncertain in their action, due to the use of two shingle nails in the underside of each, serving as guides. Close the refractory drawer, trace a pencil line each side of the slide, on the drawer bottom, and nail a couple of ¼-in. strips to the bottom for guides. Lubricate with wax, and slide troubles will be at an end.

In the hot, dry atmosphere of the modern flat, glued joints of chairs, tables, etc., will persist in coming apart, and in most cases, the inexperienced repairman simply coats the joint surfaces with some form of glue, jams the parts together again, and calls it a job. Don't do this. Carefully scrape all the old glue from the surfaces to be joined, and wash with hot water. In other words, make the surfaces as near to their new condition as you can, since a good job cannot be done over old glue. Now coat with a good prepared glue, which is better than hot glue for the amateur, fit the parts together carefully and improvise some means of clamping the pieces together until the glue has dried. On small articles, the vise can be used as a clamp, and on larger articles, such as tables and chairs, a long stick with a crosspiece nailed on at each end and with wedges used between the crosspieces and the article being repaired, will serve excellently as a clamp. Even a stout string, looped over the piece, and twisted by means of a stick thrust between the parts of the loop, will do as a clamp for many pieces. Examine the loose joint, and see if the addition of a dowel would make it stronger and prevent it from coming apart again; if so, after the joint has been glued and the glue has set, drill and glue in the dowel, preferably while the work is still in the clamp.

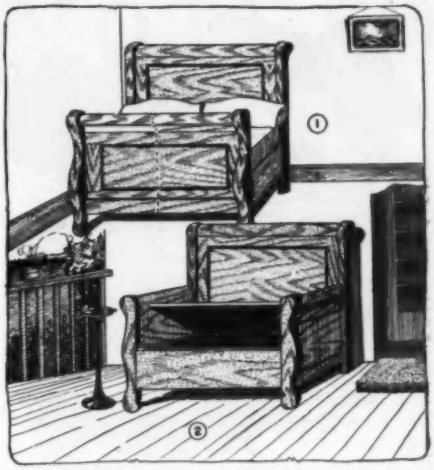
Never drive a screw into hardwood, especially if the wood is thin or of small section, without first drilling a small hole to start the thread. If this precaution is omitted, the usual result is a split piece of wood. Rub the threads of the screw over a cake of soft soap before driving, and it will be found much easier to drive. Beeswax is still better, but the soap is as a rule at hand, while the wax is

not. Paraffin wax is not so good, as it is harder and more brittle, and will not stay on the threads. Even when nailing in such woods as fir, it will often be found a good idea to drill a small lead hole to prevent the nail from splitting the wood. Of course, lead holes of this kind must be made as small as possible.

Renewing Gasoline-Lamp Generators

Gasoline-lamp generators are usually thrown away as soon as they become carbonized to such an extent that they will no longer pass the minute jet of gas necessary for the operation of the mantles, making the generators useless. The average life of a generator if in constant use is about three months. The writer experimented with a number of old generators, which were entirely carbonized, and salvaged nearly all of them, making them as useful as new ones. To do this, remove the tip and gently tap the tube with a small hammer, being careful not to dent the tubing. This will break up some of the carbon. Then get a length of slender but stiff steel wire such as piano wire or an old hatpin. Heat the tip and bend it over to form a tiny barb and then reharden it, which is done by heating it to a cherry-red and dipping in cold water. Insert the wire, barb first, into the upper end of the generator until it touches the carbon. Twist and push to dig the carbon out. After most of the carbon has been removed in this way, blow out all the loose pieces and dust. When finished, replace the tip. Test the air flow by blowing through the generator, holding the open end over a dampened spot on the hand. You should feel a cool flow of air. Then insert a new asbestos wick.—L. B. Robbins, Harwich, Massachusetts.

Old Gasoline-Lamp Generators Can Be Renewed by Cleaning Out the Carbon



Old Bedstead Can Be Converted Into Porch Seat or Hall Chair

Porch Seat Made from Old Bedstead

Old wooden bedsteads that have gone out of style or been replaced by newer models, are frequently stored away in the attic and forgotten. Such an article can be put to good use by converting it into a porch seat or hall chair, as shown in the drawing. The footboard is merely sawed in half as indicated by the dotted lines, and the halves are fastened to the headboard. If the bedstead is too high for use as a seat, the legs can be cut down or perhaps it may be possible to lower the top, depending on the particular style of bed being reconstructed. The side rails of the bedstead can be used for making the box seat, the top of which should be in one piece, preferably plywood, and should be hinged so that the space can be used as a convenient place for storage.—J. S. Hagans, Chicago.

Simple Holder for Flashlight Provides Illumination for Baiting the Line

Lamp for the Fisherman

Anyone can make this handy attachment for holding a flashlight. Although the holder has been found particularly useful to fishermen, before or after daylight, it will be found convenient for other purposes as well. Get two strips of spring brass, or other spring material, and bend them so that the flashlight will slip through easily. Then attach the strips to the side of the tackle box as shown. A flat brass strip, bent at right angles and attached to the box, serves as a stop and prevents the flashlight from slipping through. If you have no flashlight of the type shown, it is an easy matter to place the holders horizontally or at a slant to accommodate the usual type of flashlight.—Myron L. Harmon, Chicago.

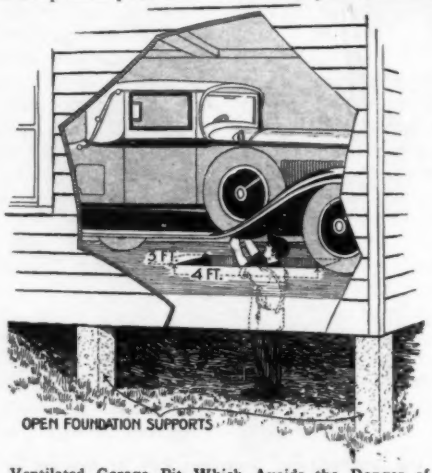
¶A length of No. 8 wire, bent in the form of a hook and fastened to a long pole, is handy for the purpose of snaring chickens by the leg.

Easily Made Name Plates

Brass or copper-faced name plates for machinery, doorplates, etc., can be made easily and cheaply as follows: Set up the desired lettering in rubber or metal type and make a plaster-of-paris impression. Inclose this in a frame the size of the desired plate and 1/16 in. deep. Use either copper or brass filings for the facing material. These must be thoroughly washed in soldering flux and allowed to dry, after which they are sprinkled in the impression left by the type. Fuse a compound of 7 parts of lead to 3 parts of block tin and pour it into the open mold. When the metal has cooled somewhat, but is still soft, press it with a flatiron, or a similar object, to force the metal into the corners and remove all air. When cool, remove carefully, trim and finish on the face with a piece of emery cloth laid flat on a board. Before pouring, or before applying the filings, the mold should be carefully dusted with black lead. If this precaution is not observed, the mold may be damaged when the casting is removed. If only one plate is to be made, this is not necessary.

Well Ventilated Garage Pit

In the usual type of garage pit no provision is made for ventilation to carry off carbon-monoxide gas and gasoline fumes. The gas being heavier than air settles in the low places and stays there, endangering the worker's life. To provide ventilation, excavate the earth under the floor where the pit is to be located and substitute posts or other supports for a section of the foundation wall. This will allow the gas to be carried off outdoors. During cold weather, such a pit can be completely boxed in except for two ventilation holes, which may be closed after the pit has been aired.



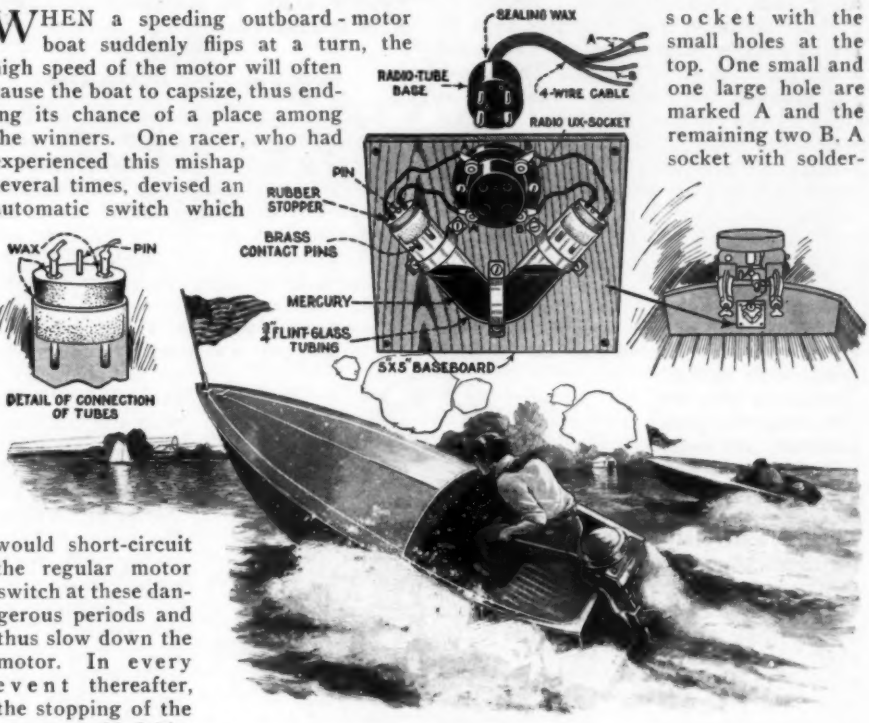
Ventilated Garage Pit Which Avoids the Danger of Carbon-Monoxide Poisoning

SHOP NOTES

Automatic Switch for Outboard Speedboats

By L. B. ROBBINS

WHEN a speeding outboard-motor boat suddenly flips at a turn, the high speed of the motor will often cause the boat to capsize, thus ending its chance of a place among the winners. One racer, who had experienced this mishap several times, devised an automatic switch which would short-circuit the regular motor switch at these dangerous periods and thus slow down the motor. In every event thereafter, the stopping of the power enabled him to right the craft before a capsize could result. A refined adaptation of the original idea is shown in the accompanying sketches. It is simple and inexpensive to construct, and, while it is a permanent fixture on the boat, it will allow the motor to be instantly removed when desired.



Make the base of any suitable wood, about 5 in. square. At the middle top of the base attach a good make of UX radio socket with the small holes at the top. One small and one large hole are marked A and the remaining two B. A socket with soldering tabs is preferred. Next get a piece of flint-glass tubing, ¾ in. in inside diameter and about 6 in. long. Heat the tube in the center over an alcohol flame very carefully until it is pliable enough to be bent. Work carefully and make the bend without pinching the diameter any more than necessary, and have the two arms at exact right angles to each other.

Mount the bent tube on the center of

the board so the two arms point upward at 45° as shown. The mounting is done with three light metal straps, one bent over each arm and one placed vertically over the bend. Use screws in fastening the strips so they will not pull out from vibration.

Fit a new rubber cork to each opening of the tube and then drill two small holes through each stopper, at least 3/16 in. apart. Into these drive brass pins which will project below the bottom of the stoppers about 1/2 in. The tops of the pins must stick out of the stoppers sufficiently to allow leads to be soldered to them.

Pour mercury into the tube until its level comes just above the top of the bend when the base is held level. Then push the prepared stoppers into the tube as tightly as possible so the line of the pins will come at right angles to the baseboard (not as shown). Drive a brad or similar pin into the board and against the stoppers, so these will not work out. Then paint the seams and the openings about the pins with any good waterproof wax to seal them.

Connect as shown, with pieces of waterproof insulated wire soldered to pin tops and socket contacts. Paint all exposed metal with shellac. Prepare a plug by removing the glass from an old radio tube and soldering the leads inside to a four-wire cable having waterproof insulation, or one well taped, to keep out moisture. Then fill the inside of the shell with sealing wax. Properly prepared, the plug will fit in the socket with the pin uppermost.

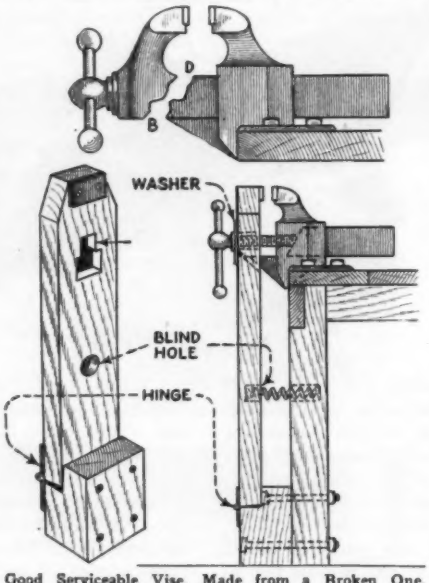
Screw the automatic switch to the inside of the boat transom between the motor clamps as suggested. Then connect two cable leads, A and B, to the regular motor cut-out on one side and the remaining A and B to the other side of the switch. Plug the cable into the socket, and the switch is ready to take care of the motor.

Test by running the motor at the dock and tipping the boat over to either side at a dangerous list. If the motor is cut off too soon, you will need less mercury. Use just enough so the mercury will not make contact with the two pins in the tube until the list means almost a capsize. You must be the best judge of this condition, as it will vary with every boat.

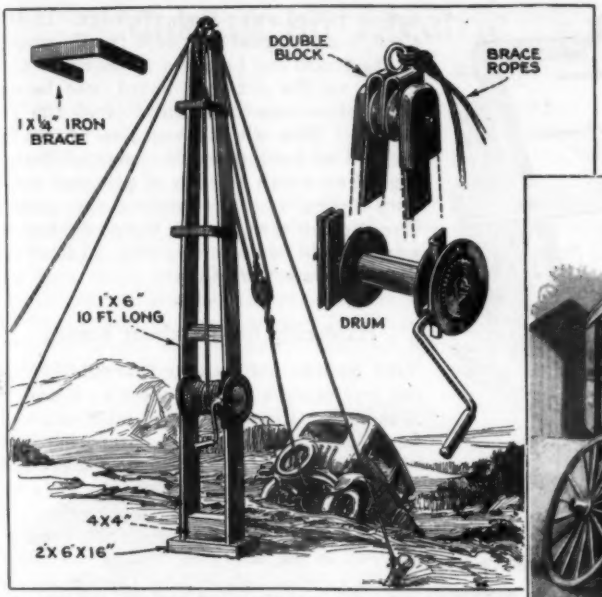
Kept dry, this switch will be found extremely useful in racing or high-speed work in small boats.

New Vise from an Old One

Small cast-iron vises usually break at the point indicated at B in the illustration. To salvage such a broken vise, I made an entirely new movable jaw of wood, the bottom end of this jaw being pivoted to a wooden block attached to the lower part of the bench leg as indicated, and the upper part fitted with the screw formerly used. Hardwood, preferably oak, is best to use for this purpose. The steel jaw of the broken part was removed and screwed to the upper edge of the new jaw, in line with the stationary jaw. A blind hole drilled in both the movable part and the leg of the bench accommodates a strong coil spring which forces the loose jaw back when the screw is loosened. The ragged portion of the vise, where it had been broken, was ground down smooth to form a sort of guide, which made a sliding fit in a square hole cut in the jaw just below the screw, to prevent side motion.—August Jeffers, Louisville, Ky.



Good Serviceable Vise, Made from a Broken One, Saves a Few Dollars



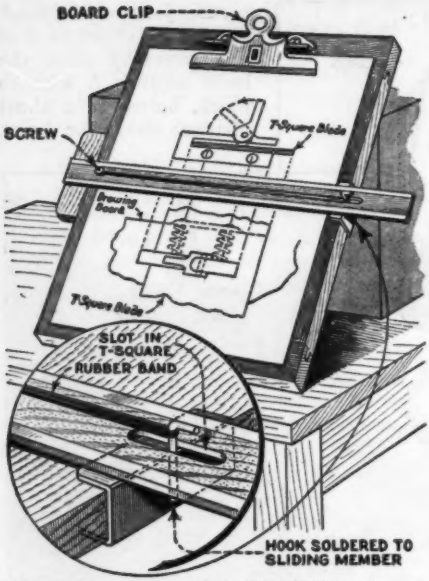
A Light But Powerful Hoist, Which One Man Can Carry, Has Been Found Useful By a Garage for Lifting Heavy Loads

This Hoist Is Light and Strong

For garages and other establishments where there is frequent need for a light but powerful hoist, for lifting cars on the road or bodies about the shop, etc., the hoist shown in the drawing will be found useful. The frame consists of two 1 by 8-in. boards, 10 ft. long, joined at the bottom by a 1½ by 16-in. plank, which is held in place by means of four bolts through a light metal plate at each end. The junction is further strengthened by the insertion of a 4 by 4-in. piece of wood between the frame boards. At about the height of a man's waist the hoisting drum is inserted between the boards, in bearings made of metal plate, bolted to the boards. The drum itself is made of two circular sheets of metal, ¼ in. thick and 8 in. in diameter, which are joined by welding on two 1 by ¼-in. iron straps. The latter are keyed into the rear axle of a Ford car, and the crankshaft, with a 1½-in. pinion on the end, is geared with the axle at right angles for winding up the tackle. The latter is suspended from a double block at the top of the hoist. The eye in the block is used when the hoist is employed for certain jobs on the road, and for the attachment of guy ropes to make the hoist secure. A wooden block, bolted in a short distance above the drum, stiffens the hoist at that point, and two 1 by ¾-in. metal straps, bent to U-shape, brace the frame between this block and the top, allowing the rope and tackle to swing free. A long hook from one of these braces to the crank handle is used to hold the latter in place, but a ratchet is to be added to the outer end of the Ford axle, which will simplify the holding of the load at any desired height. The entire hoist is light enough to be carried easily by a single man on his shoulder.

Cleaning Brass Fixtures

Brass rules used in a printing office, or brass fixtures of any kind, can be cleaned with acetic acid. It is the best cleaner obtainable. Acetic acid is simply strong vinegar and can be purchased at any local drug store. Its action against fly specks is hastened by the addition of salt. This substance is not harmful to the hands and can be used without injury. The brass should be wiped with a dry cloth after the acid has removed the tarnish. It is also excellent for washing grease or fly specks from glass articles, especially windows.—Loren Ward, Des Moines, Iowa.



A Few Trouble-Saving Kinks That Will Be Appreciated by Draftsmen

Clamp Keeps T-Square from Sliding on Sloping Board

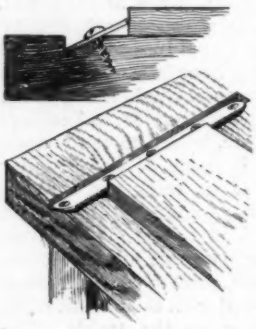
When a T-square is used on a sloping table it naturally tends to slide down. Although not a regular draftsman, I have found a method of holding the T-square to the board wherever it is placed. Get a piece of sheet metal and bend it to a U-shape so that it will fit on the edge of the drawing board. The clamp should be slightly longer than T-square is wide, and part of an L-hook is soldered onto it as shown in the detail. A slot, cut lengthwise in the center of the T-square blade, near the end as indicated, permits the hook to project above the board when the clamp rests against the side of the drawing board. Drive a small round-head wood screw into the top of the T-square, also in the center, allowing it to project above but not below the square. Snap a rubber band over the screw and the L-hook. It is not necessary to locate the screw near the head of the T-square as shown; it may be placed only a short distance from the slot. The tension supplied by the rubber band keeps the clamp tightly against the edge of the drawing board. When the T-square has to be moved, the clamp is simply pulled away from the edge. If desired, a clamp that will hold the T-square to the board can be made as shown in the detail on the drawing board, use being made of an eccentric cam to pinch the T-square. The illustration also shows a method of holding small sheets of drawing paper, which consists in using an ordinary spring clip for holding the paper. The clip is screwed to the top of the board where it will be out of the way.—Victor A. Stewart, New York City.

Hardening Steel without Scaling

To harden polished-steel articles without producing a scale, proceed as follows: A mixture of equal parts of table salt and finely ground cornmeal is prepared, and the article is first dipped in water and then into the mixture. Place in a fire and, when hot enough to melt the particles adhering to the surface, take it from the fire and roll in the mixture. When it is completely covered, place it in the fire again and heat sufficiently for hardening. Watch that no part shows signs of becoming dry. If such spots show up, cover them with the mixture, as this mixture forms a coating that keeps the air from striking the metal, thus preventing oxidation. When cooled in water, the coating readily comes off, leaving the surface smooth.

Hacksaw Blade Makes Good Bench Stop

Work will often turn sideways on a narrow bench stop, but this trouble is entirely overcome by using a 10 or 12-in. piece of an old hacksaw blade for the purpose. It is securely screwed to one side of a shallow "V" cut in the bench top as shown. The blade is annealed so that several screw holes can be drilled. The toothed edge is raised to catch the work. Such a stop can be made in a few minutes' time.



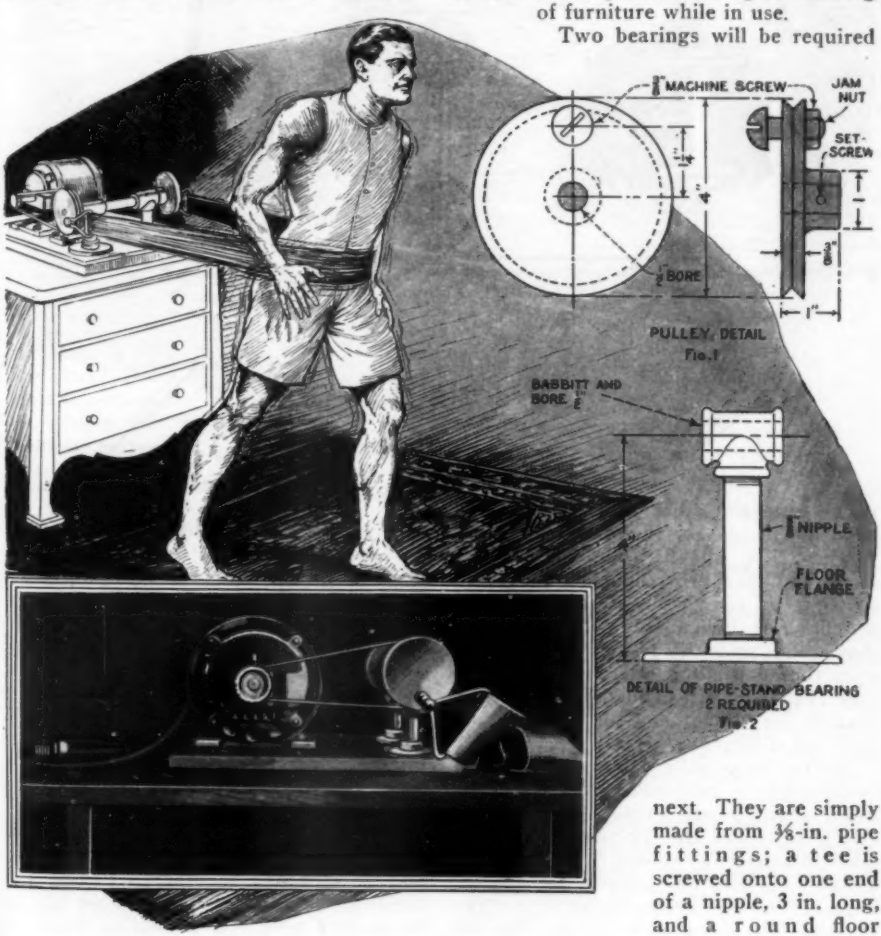
Making an Electric "Exerciser"

By R. M. KOCH

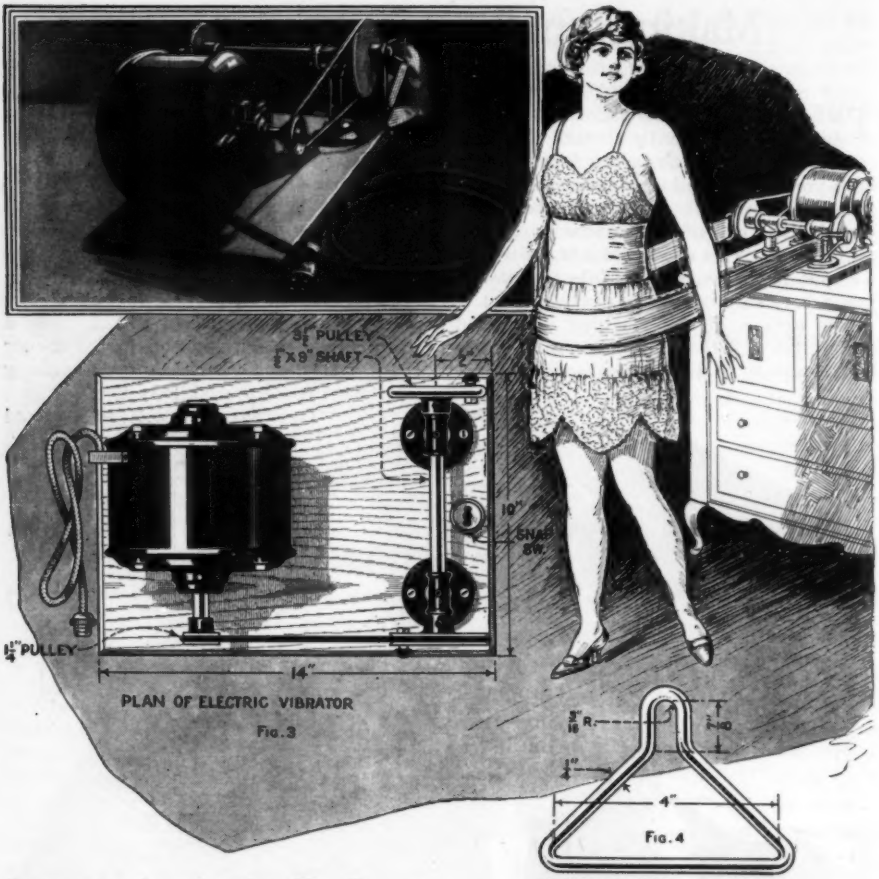
THE MODERN tendency in exercising devices is apparently toward the electrically driven vibration machines. Perhaps you may have had a desire to possess one—just to try the thing out—but have found the cost of the machines as yet quite high. You can build one, however, without much expense or labor, that will prove very satisfactory in every respect.

The details of the machine illustrated are simple and the equipment required is little more than a small motor, two bearings, pulleys, and a massaging belt. Any ¼-hp. electric motor will be satisfactory, provided it is of the proper voltage for your house current. Mount the motor on a wood base, about 10 by 14 in., the corners of which may be neatly beveled, then sanded and finished in any of the popular lacquer finishes, or stained and varnished. The approximate position of the motor is indicated in Fig. 3. Put a small rubber or felt pad under each corner of the base to prevent sliding or marring of furniture while in use.

Two bearings will be required



next. They are simply made from ⅜-in. pipe fittings; a tee is screwed onto one end of a nipple, 3 in. long, and a round floor



PLAN OF ELECTRIC VIBRATOR

FIG. 3

FIG. 4

DETAIL OF HOOK, 2 REQUIRED

flange onto the other (see Fig. 2), care being taken to have them both the same height. Now fill the tees with babbitt metal and then drill and ream for ½-in. shafting, or you may bolt the stands on the base as indicated, babbitting while they are set up with a ½-in. shaft, wrapped with thin paper for clearance. A small hole should be drilled in the top of each bearing for oiling, and an oil reservoir provided if desired.

The two large pulleys may either be cast or turned from cold-rolled steel, bored for ½-in. shafting and provided with ¼-in. safety setscrews on the projecting hub. Their diameter, as shown, is to be about 3½ or 4-in., with one grooved for a ¼-in. V-belt; the other need only have the edges rounded. The motor pulley is also grooved for the belt, 1¼ in. in diameter, ½-in. bore —the usual size of a ¼-hp. motor shaft. The shaft may be ordinary cold-rolled steel, cut 9 in. long. The 3½-in. pulleys are now to be drilled with a 5/16-in. hole 1¼ in. from the center, and tapped ⅜-in. U. S. S. thread. A ⅜-in. capscrew or machine screw, 1 in. long, is driven into each hole until 5/16 in. projects from head to side of pulley, then locked with a jam nut, as shown in Fig. 1. These eccentric screws impart the vibratory motion to the exerciser belt.

Now two hooks should be made from a ¼-in. rod. About 3 ft. of this material will be sufficient for them. Follow the dimensions given in Fig. 4. They are to be hooked over the projecting parts of

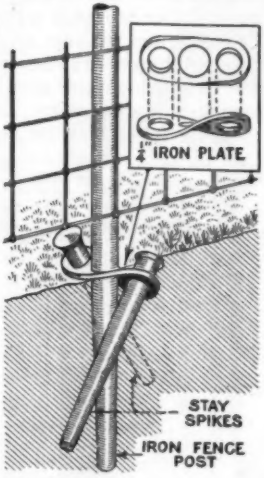
each screw on the pulleys. Sew a hook on each end of the massaging belt, which is made from a piece of heavy ducking, 4 in. wide and from 7 to 9 ft. long, with the edges hemmed. A piece of canvas webbing, 4 in. wide, is all the better.

The parts now are all mounted and properly alined to turn easily, the V-belt put in place, and the eccentric screws on the two pulleys fastened diametrically opposite, that is, have one moving toward you and the other away from you. Hook on the massage belt, put the machine on a table and it is ready for use.

It may be necessary to fasten the vibrator to the wall as it sometimes slides on the table. A screweye in the wall and another in the back of the base, joined with a small leather strap, will do very well in such case. Another thing: Put a switch in the cord of the motor and have the cord long enough so you can hold it in your hand when using the machine. This gives you instant control and enables you to get the vibrator belt placed wherever wanted before starting the motor.

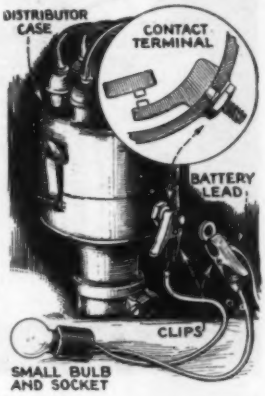
Steel-Post Fastener Prevents Side Movement

Small, tubular steel posts, which are driven into the earth, are handy to use but have the disadvantage of turning and sagging, especially if the earth is rather soft. To prevent this trouble, the simple method shown in the drawing, can be used. A ¼-in. iron plate, drilled to fit the fence post and to receive two stay spikes, and bent to the shape indicated, is provided for each post. The long spikes provide additional anchorage which holds the post up securely.



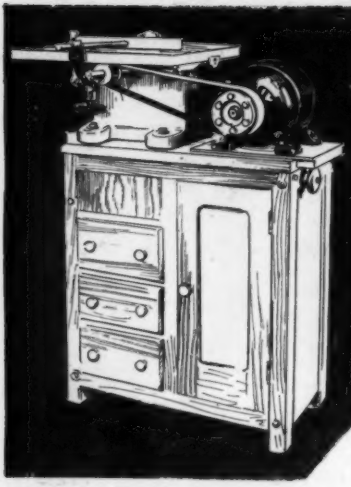
Lamp Used for Spark-Position Indicator

A simple tester that will indicate the time of the spark with respect to the position of the piston, is shown in the drawing. It consists of a small lamp, socket, wires and clips to permit quick connection. In use, the primary wire leading from the battery is disconnected from the terminal at the interrupter, while one end of the tester is connected to the wire and the other end to the terminal. This places the lamp in the circuit with the ignition current. When the lamp is burning, it indicates a current flowing, while the opening of the contacts is indicated the instant the lamp goes out. The outfit is also useful in making tests of the ignition circuit, inasmuch as the alternate lighting and extinguishing of the lamp shows that the wiring up to the interrupter, and the interrupter itself, are functioning properly. Trouble in ignition would be in the coil under these conditions.



Cutting Brass Tubes

When cutting brass tubes by hand, use the back of the hacksaw blade, held in the ordinary frame. This cuts very fast and works fully as well as a regular tube-cutting saw on very light tubes. Tubing will collapse when held in a vise, unless it is filled or held in circular jaws. To put a piece of round steel into the tube is good, and it need not fit closer than 1/32 in., for the elasticity of the tube will make up for the difference. Stock within this limit is usually at hand. For flaring the ends of brass tubes, punches and dies are usually necessary, but if the flare does not have to be very great or too accurate, it can be accomplished by the use of a punch, or punches, alone.



SAW MOUNT HAS UNIQUE

WHERE portability, compactness and general cleanliness about the bench are necessary to the satisfactory operation of the bench saw, a floor mounting is the solution of the problem. A suitable mounting for the average saw table must combine several features. First, the arrangement must be rigid; second, the assembly must be easily moved about, and, third, there must be some means of quickly adjusting the belt tension.

In addition to these essentials, an adjustment, whereby the saw table may be lowered to the level position when using the dado head to cut shallow grooves or rabbets, is eminently desirable and adds, moreover, an element of safety not present when the table is tilted for this operation, which is necessary in dadoing operations on the majority of bench-saw outfits. A saw table tilted, or otherwise out of plumb, is dangerous at best, as there is always the possibility of a small piece of stock sliding unnoticed down into the fast-running dado head, which is more than likely to cause a serious accident. As a rule, the arrangement for raising and lowering the table consists of a hinge at the back of the table and a palm screw and locknut at the front, for preserving the adjustment. All workers are acquainted with this one objectionable feature; otherwise there is no fault to be found with the saw table itself.

The mounting illustrated eliminates this objectionable characteristic and embodies the other features mentioned. The motor is mounted on the same level as the saw frame, to obtain the required adjustment when lowering the table, and the space below saw and motor is made use of by the construction of drawers and a compartment. The motor is quickly adjusted for belt tension in any position, and the upper drawer catches the dust, which aids greatly in keeping the shop clean. Lastly, the saw table may be leveled

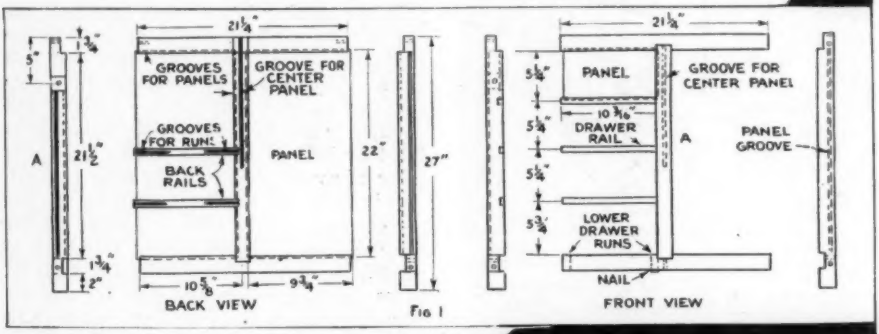


FIG 1

FOR HOME SHOP FEATURES

by

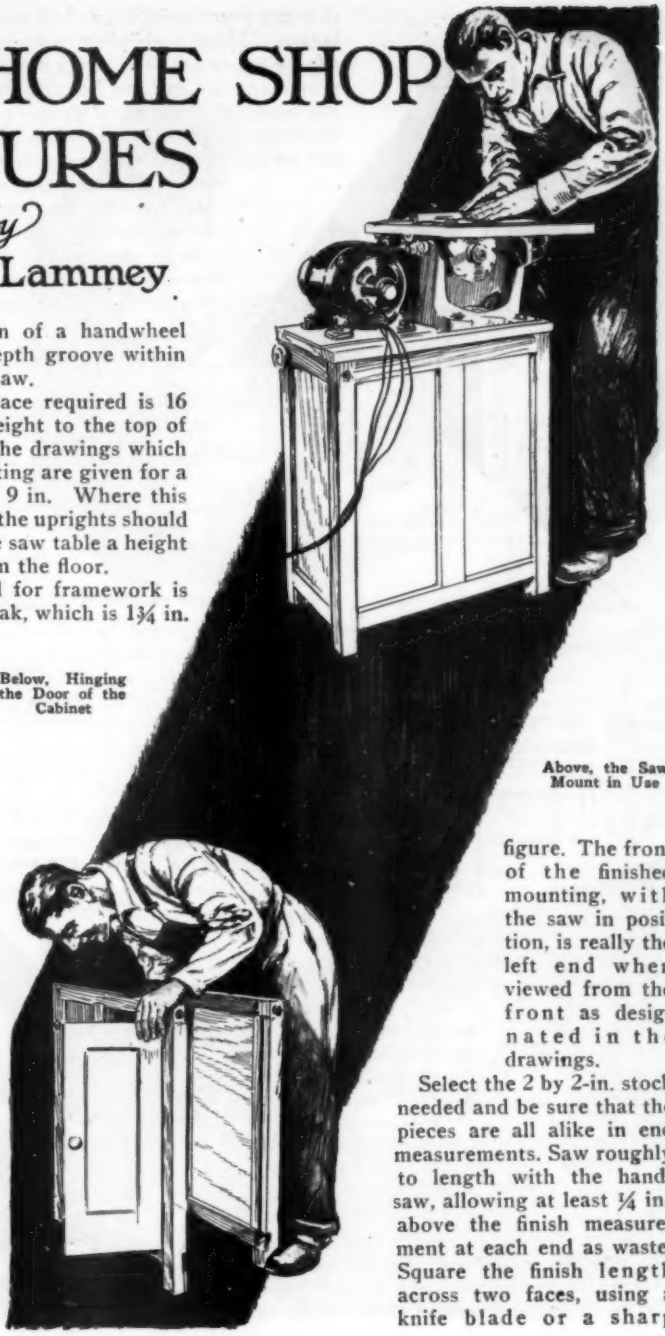
W. Clyde Lammey

by the simple action of a handwheel when cutting any depth groove within the capacity of the saw.

The total floor space required is 16 by 26 in., and the height to the top of the table is 37 in. The drawings which dimension the mounting are given for a saw-frame height of 9 in. Where this is less, the length of the uprights should be altered to give the saw table a height of at least 36 in. from the floor.

The material used for framework is ordinary 2 by 2-in. oak, which is 1¾ in. square in the finished dimension. Should the worker desire to dispense with the drawers and closed compartment, omit the mortise cuts for the drawer rails on the front of the mounting and, in place of these, run grooves for paneling, as for the back. However, experience has shown that the drawers and compartment were well worth the extra time and labor.

To prevent confusion in the text the "front" of the mounting will mean that shown in the "front view" in Fig. 1 and the "back" that shown in the same



Above, the Saw Mount in Use

Below, Hinging the Door of the Cabinet

figure. The front of the finished mounting, with the saw in position, is really the left end when viewed from the front as designated in the drawings.

Select the 2 by 2-in. stock needed and be sure that the pieces are all alike in end measurements. Saw roughly to length with the handsaw, allowing at least ¼ in. above the finish measurement at each end as waste. Square the finish length across two faces, using a knife blade or a sharp

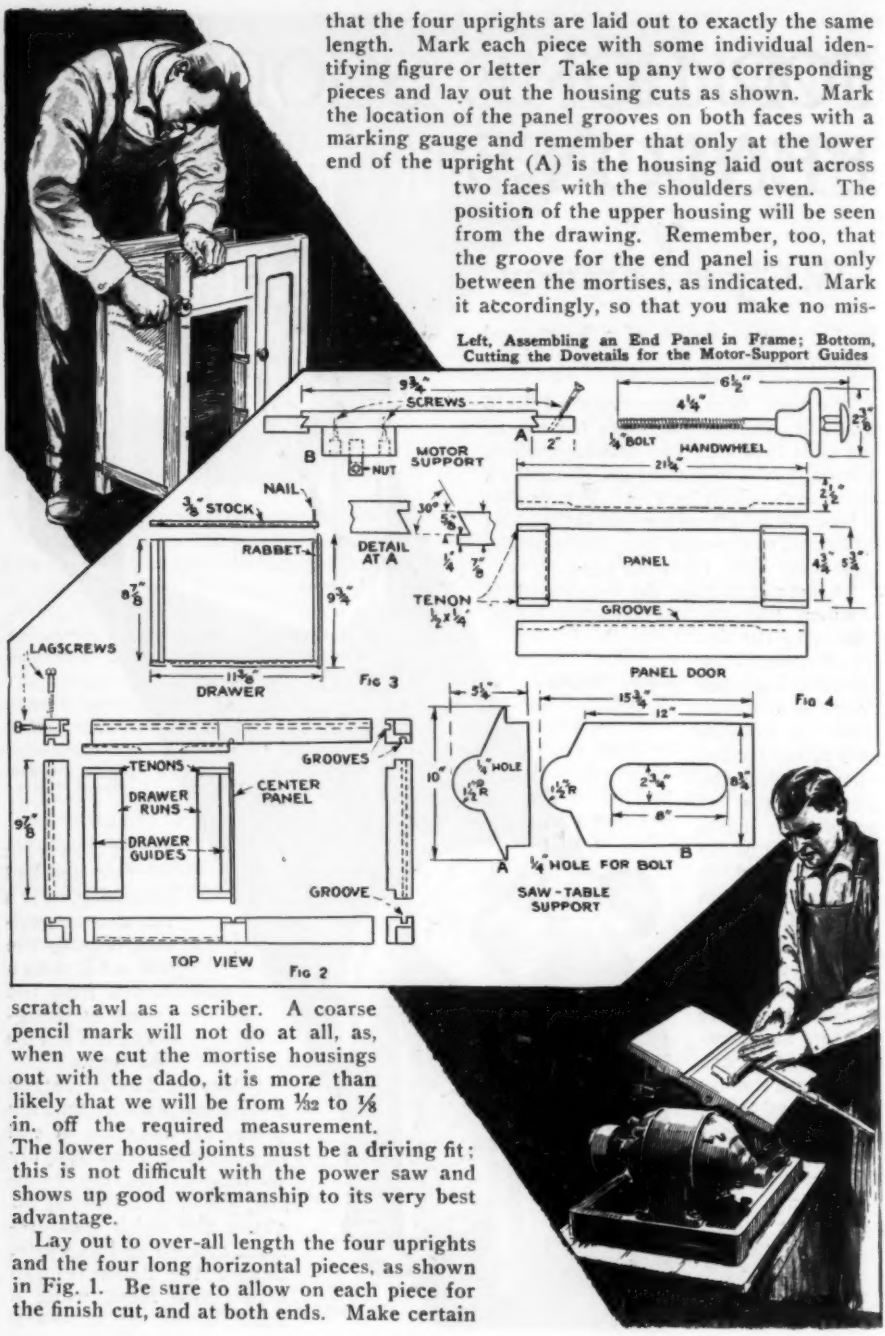


Fig 3 Fig 4 Fig 2

Left, Assembling an End Panel in Frame; Bottom, Cutting the Dovetails for the Motor-Support Guides

that the four uprights are laid out to exactly the same length. Mark each piece with some individual identifying figure or letter Take up any two corresponding pieces and lay out the housing cuts as shown. Mark the location of the panel grooves on both faces with a marking gauge and remember that only at the lower end of the upright (A) is the housing laid out across two faces with the shoulders even. The position of the upper housing will be seen from the drawing. Remember, too, that the groove for the end panel is run only between the mortises, as indicated. Mark it accordingly, so that you make no mis-

scratch awl as a scriber. A coarse pencil mark will not do at all, as, when we cut the mortise housings out with the dado, it is more than likely that we will be from 1/32 to 1/8 in. off the required measurement. The lower housed joints must be a driving fit; this is not difficult with the power saw and shows up good workmanship to its very best advantage.

Lay out to over-all length the four uprights and the four long horizontal pieces, as shown in Fig. 1. Be sure to allow on each piece for the finish cut, and at both ends. Make certain

take when cutting the groove.

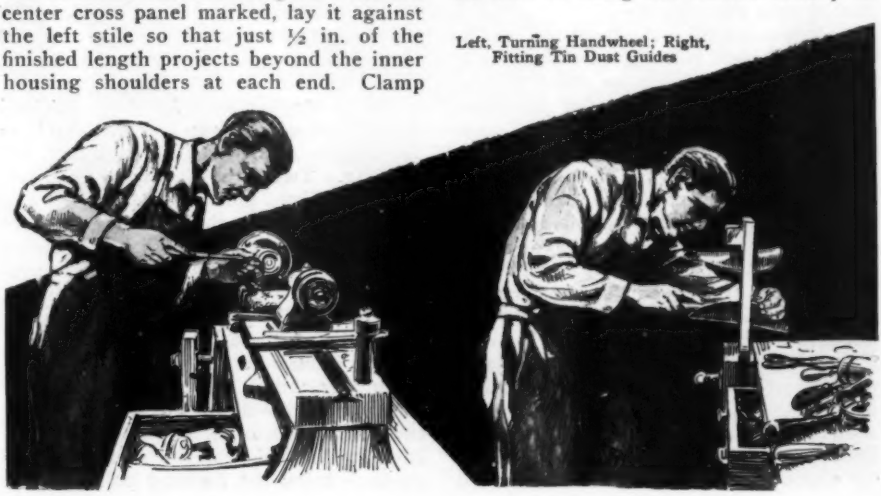
Next, mark to length the two rails in the back view, and lay out the double mortise only on what is to be the top piece. Locate the mortise exactly in the center between the finish marks. Mark also the position of the panel grooves, using the same setting of the marking gauge as before. Lastly, mark the center stile (upright) in the same drawing to a finish length of exactly 22½ in. Indicate the groove for the center panel and lay all pieces separate from the others.

Hinging the Saw Support to Its Crosspiece

Lay out the front half of the frame, remembering, unless we are to dispense with the cabinet, that the grooves for the panels are indicated only on the inner faces of the stiles and for the small lengthwise panel, as shown above the top drawer. When the center stile in the front view has been laid out and the groove for the center cross panel marked, lay it against the left stile so that just ½ in. of the finished length projects beyond the inner housing shoulders at each end. Clamp the pieces together so that they cannot shift. When in this position, the housings for the drawer rails are laid out across the outside faces of both pieces. Distances given are from center to center of the rails. Select a piece of oak stock of a uniform thickness, and of such size as to be ample for the three rails, and mark the housings to this thickness.

When the layout is complete and the pieces have been laid in order, cut to length on the power saw and make the cuts for the housings. Saw always in the waste. Remove the saw blade after the sawing operation is finished and put on the dado head, set to make a ⅜-in. cut. This is much faster in hardwood than a wider cut. Set the table to make a cut exactly ½ in. in depth and run all the mortise cuts, using several strokes to remove all the waste from each. Be sure to bring the cutters exactly to

Left, Turning Handwheel; Right, Fitting Tin Dust Guides



the line when cutting the shoulders. Next, run the ¼-in. panel grooves, making the cut about ¼ in. deep. Stop the grooves at the inner housing shoulders on the inside face of the center stile in Fig. 1, back view, and corresponding piece in the front view; also the short panel groove on the long horizontal and the center upright in the front view.

Bore all lagscrew holes with a ¼-in. bit and those in the end grain, in which the screw is to tighten, with a 5/16-in. bit. Where crosspieces join uprights, the holes are bored one slightly above the other so that the screws do not interfere. The lagscrews used were ¼ by 3 in., with washers. Tighten the back frame together with clamps and locate the pieces exactly in position. Insert the 5/16-in. bit in the holes for each mortise and turn up the point by hand to locate the holes accurately. Do the same with the front section of the mounting, after which bore the small holes. Set up the back first. Join the two end stiles with the lower rail, using glue in the joints. In tightening the lagscrews, be careful not to strip the threads in the end grain. Put the center stile in place and tighten. Cut out the panels from ¼-in. three-ply stock to an easy fit in the grooves. The panels should not fit tight, as they are apt to swell in damp weather with such force as to break the glue joints. Trim them to a loose fit, and tap in place. Put the upper rail in place, glue the joints, and tighten the lagscrews.

Before assembling the front section, rip stock for drawer rails 1¾ in. wide and 3 ft. long. Cut from this piece three lengths, each 12 in. Groove one for the small panel. Assemble with the center stile and lower rail. Place the top crosspiece in position and clamp. Obtain the exact length of the drawer rails while the frame is thus in position, and cut all three rails to length. Drive top rail in place, with groove up, remove clamp and upper rail and fit the small panel, after which tighten the top piece in position permanently. Do not put in the lower rails.

For the two back drawer rails, rip pieces to 1¾-in. width and cut them for length to the distance between the grooves, as shown. To locate them, set the front and back sections together and mark along the edges of the two lower rails. Cut the grooves for the tenons on the runners as shown, ¼ by ½ in. deep. Notch over the uprights and glue in place.

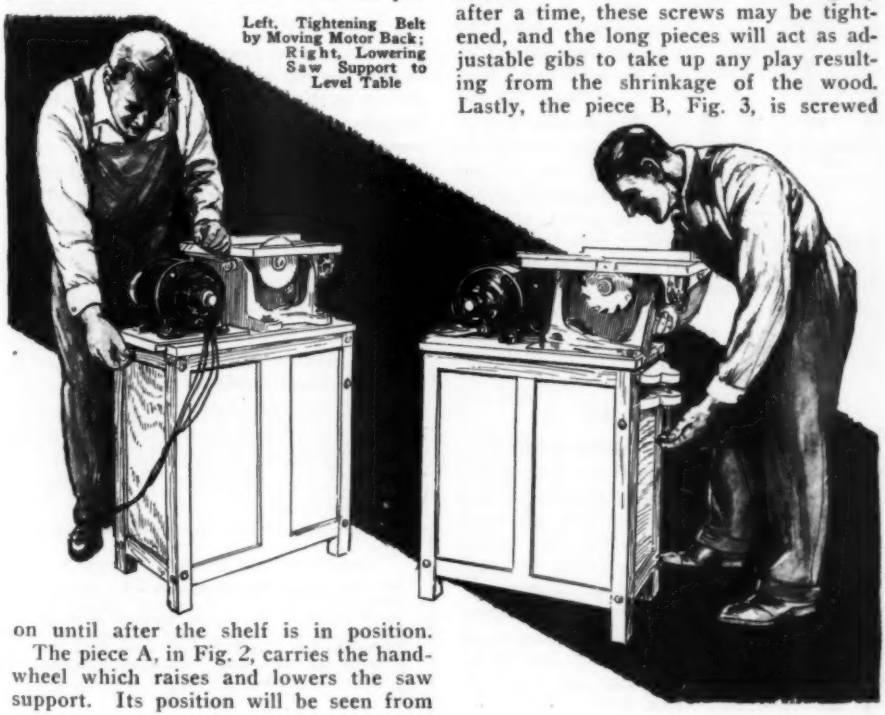
Fit up the end frames and panels the same as the back. Run grooves on the edges of the front rails, rip the runners to the same width and cut a ¼ by ½-in. tenon on one end. Tap one of the rails in position and lay the runner across the top, with the shoulder of the tenon against the edge of the back rail. Mark the length and shoulder of the tenon, cut the three other runners to the same length and tenon the ends. Drive the tenons in place in the back rails and tap the front rails into position. Use glue on all joints. Cut the center cross panel to width and approximate length and drive it down until the end joins the upper runner. Allow a ¼-in. projection above the ends of the center uprights, to take the groove in the center crosspiece. Nail the panel to the runner, to prevent the dust from getting into the compartment. Put in the drawer guides, as shown in the top view, Fig. 2. Fig. 3 dimensions the drawer construction. Fit each drawer in its individual compartment. Nail a thin piece of stock over the opening under the top drawer, of such size that it will not interfere with closing. In case the drawer overflows, the dust will then be prevented from falling into the second when the upper drawer is removed.

Figure 4 details the construction of the compartment door and makes its dimensions and assembly clear. Groove all pieces for ¼-in. paneling, glue up and clamp until dry. Hinge the door and use a round-nosed or bullet catch to shut it.

Turn a wooden head for the handwheel to the dimensions given in Fig. 4 and bore for a ¼-in. round-head carriage bolt, 6½ in. long. Two handwheels are required, exactly alike. Obtain a ¼-in. die and stock and run the threads back on both bolts to 4¼ in. Drive the bolt through the wooden head, seating it tight, to prevent turning. Cut out the saw support, composed of the pieces A and B in Fig. 2. Leave the width of B somewhat oversize, so that it may be trimmed to a tight fit when assembling. Common oak, ⅞ in. thick, will do well for these parts. Rip two pieces, each 24 in. long and 2 in. wide, from ⅞-in. stock, for the motor-support guides. Mark the halfway point on the

face and edge of each. Tilt the table of the saw to 30°, and raise it until the blade cuts ⅝ in. deep. Test the setting on a piece of ⅞-in. waste, until the angle cut is like that shown in the detail at A, Fig. 3. Run the angle cut on both pieces back past the halfway point, after which level the table and raise it until the blade cuts just deep enough to meet the angle cut. Cut off the waste with a chisel.

Saw out the motor support to 10-in. width and 12½-in. length and, using the same angle and setting as described above, run the angle cut on one edge of the piece. Place the two long pieces in position and lock them with clamps. Be sure that the edges are flush with the inner edges of the crosspieces of the frame. Mark the exact width of the motor support and complete the dovetail cut on the remaining edge of the shelf. If the saw table used does not tilt, simply run a ⅝ by ⅜-in. rabbet on both edges of the support and the same on both the long pieces. The piece shown at B, Fig. 3, which carries the nut, is held in place with screws and should not be put on until after the shelf is in position.



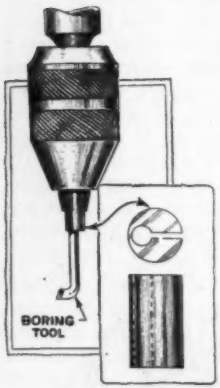
Left, Tightening Belt by Moving Motor Back; Right, Lowering Saw Support to Level Table

The piece A, in Fig. 2, carries the handwheel which raises and lowers the saw support. Its position will be seen from the drawings. Be sure to fit it tightly between the stiles and fasten it securely with screws and glue. Cut a piece from 2 by 2-in. stock 9⅞ in. in length and groove one face to take the center-panel projection. Hinge this to the piece supporting the saw, as shown in the drawing, page 169. Make sure that the piece is square with the support and that the ends project ½ in., to fit the housings in the frame. Nail two small pieces of tin in the rounded ends of the dust opening in the saw support; these will aid in throwing the sawdust into the drawer below. Put the support in place, trimming it to a good fit between the uprights of the frame, so that it can be raised and lowered easily. Run the hand screw up through the nut, to bring the support to the level position. Drive lagscrews through from the outside of the frame, to hold the center crosspiece solidly. Place the long pieces in position and slide the motor support, or platform, to the forward position. Lock the pieces down with screws, driven in at an angle as shown. When the wood shrinks slightly after a time, these screws may be tightened, and the long pieces will act as adjustable gibs to take up any play resulting from the shrinkage of the wood. Lastly, the piece B, Fig. 3, is screwed

in place. Mortise the nut in the wood and bore a hole in the wood for the threaded end of the bolt, as shown. Have the motor platform in the forward position. Bore a hole through the upper crossrail at the end and insert the hand screw. Tighten the screw through the nut, until the end of the threaded bolt projects slightly beyond the wood, and screw the block in place. Fill the mortise holding the nut with plastic wood, so that the nut does not drop out when the handwheel is removed. Do not use glue on any part of the above assembly.

Lock the saw frame to its support with lagscrews, and drop the shelf, or platform, to the lowest position likely to be required to level the table for very shallow grooves. Slacken the motor slide until it reaches the forward position. Place the motor, line the belt carefully, and bolt the motor down. The illustration in the heading, taken from a photo, shows the outfit in operation, cutting a very shallow groove in light stock. Note that the motor is in the forward position, with the saw frame lowered to level the table. This position of the motor is necessary to obtain the required belt adjustment when raising the saw frame to the level position.

Adjustable Boring-Tool Holder



The adjustable boring-tool holder shown in the drawing can be made by any machinist in half an hour and will be found to be of considerable utility. It consists of a 2-in. length of ½-in. brass rod, drilled lengthwise eccentrically, as indicated, and slotted through the thickest part of the wall. The boring tool is inserted in the holder, which is then chucked in the drill press. Adjustment for size of hole to be bored is obtained by loosening the chuck and turning the tool.—Chas. Kugler, Philadelphia, Pa.

Colored Concrete

Concrete and stucco can be colored by using the following pigments: lampblack, manganese dioxide, for gray and slate; red iron oxide for red; English red oxide for bright red; brown roasted iron oxide, brown ocher, for brown; ocher for yellow; ultramarine for blue; chromium oxide, ultramarine green, for green; violet oxide of iron for violet. The amount of pigment used should be small, owing to the possibility of impairing the strength of the concrete. The limit should be about five per cent by weight to that of the cement. Lampblack is best for darkening, and to lighten the color, use lime. The coloring constituents can be used dry or in a paste, but it is most convenient to use the dry form, which should be thoroughly mixed with the dry mortar before adding water.

Case Prevents Soiling of Forms

In shops where each workman is obliged to sign for the work he performs, the case shown in the drawing is a very handy arrangement for holding the forms or reports. It is made of tin and a piece of glass, with a section cut out, as indicated. This makes the report visible and at the same time leaves the space for signatures open. Its utilization saves the loss of forms and keeps them in a tidy condition. The case is particularly useful in railroad engine houses, but is also applicable to any other establishment where signatures for work performed are required.—J. R. Minter, Washington, D. C.

SHOP NOTES IN BOOK FORM

For the convenience of readers who desire a permanent collection of these notes indexed for quick reference, we publish in book form all the articles that have appeared in these pages during the year. Send 50 cents to our Book Department for latest issue; information regarding earlier issues available gladly sent upon request.

Household Short Cuts

A Baby's Bathtub

Here is a small, comfortable bathtub for the baby, and one which is very convenient for mother. Simply make a frame of 1 by 3-in. stock, the crosspieces fitting over the sides of the tub. Small blocks are nailed to the underside of the crosspieces to prevent them from slipping off. Heavy duck canvas is tacked to the underside of the frame to form the baby's tub. After tacking down the canvas, lay a thin strip of wood over the edge of the canvas and nail this to the frame, which will prevent the canvas from getting loose. Round off the edges of the frame and apply a couple of coats of white enamel. When dry, the tub is ready for use.

Canvas Bathtub Is Comfortable for the Baby and Handy for Mother

Spray for Killing Flies

An effective spray for killing flies can be made by mixing about 4 oz. of pyrethrum in a pint of kerosene. While deadly to flies, this mixture is harmless to humans and animals. Use an ordinary spray gun and close the room for a few minutes. Keep the solution away from fire, as it is inflammable.

Oiling Leather Coats

When applying neat's-foot oil to leather coats with a saturated rag, difficulty is encountered in that the oil is absorbed too quickly. It will be found easier if the oil is put into an ordinary fly sprayer and squirted on.

Sewing-Machine Kink

Take a short piece of rubber tubing which will fit on the spool holder of the sewing machine. This will provide sufficient friction to prevent the spool from turning too fast, keeping the thread taut and thus preventing tangles.

Suction Cups Keep Bottles on Shelf

To prevent bottles from falling off a shelf, tack a rubber suction cup to the wall behind each bottle, and push the bottle against it with slight pressure. When needed, the bottle can be removed, but it will not fall off the shelf if it is hit.

Substitute for Shelf Paper

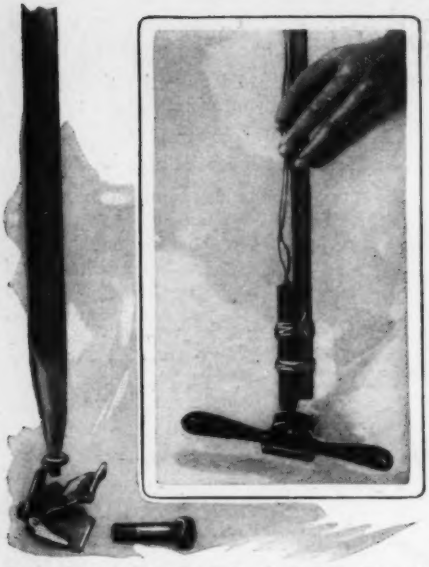
The edges of shelf paper are frequently torn and soon become soiled. To maintain a neat appearance, tack strips of embossed molding to the edge of the shelf with finishing nails and enamel it to match the color scheme of the closet. Allowing it to project a trifle above the edge of the shelf prevents the dishes from slipping off.

Glass Stoppers That Stick

When a glass stopper sticks, take an ordinary clothespin, slip it over the flat part of the stopper and twist gently. In case of an exceptionally obstinate stopper, push a second clothespin over the jaws of the first to prevent them from spreading. A pair of pliers can also be used for the purpose if the jaws are well padded.

Remember Grandma's Sun Preserves?

Delicious sun preserves can be made at any time, whether the sun shines or not, with the aid of a strong electric lamp. The berries are crushed, an equal amount of sugar is added, and the mixture is placed in small tumblers. A strong lamp, provided with a reflector, is arranged directly over them so that the light reaches each glass. A crust will form in about five days, and the preserves may then be sealed.



Two Attachments for Retrieving Small Parts Dropped in Places Hard to Get At

Recovering Small Parts from Places Difficult of Access

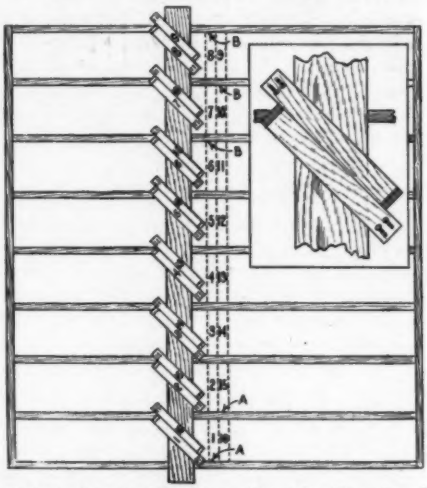
Small parts dropped in places inaccessible to the hand can be retrieved by the two methods indicated in the photo. Both make use of a long stick with an attachment to catch and hold the part to be recovered. The left detail shows a blade holder of a safety razor, the type having a spring clip to hold the blade. It is attached to the stick in the open position and slipped over the part to be picked up whereupon a slight pressure on the stick causes the jaws to snap together and hold the part securely. The second method consists in tying the core coil of a Ford spark coil to the end of a stick as shown at the right. Two wires carrying current supplied by two dry cells are run along the stick and connected to the ends of the coil. Quite a heavy piece of iron or steel can be picked up by this magnet.

Bronze Surface for Yellow Brass Castings

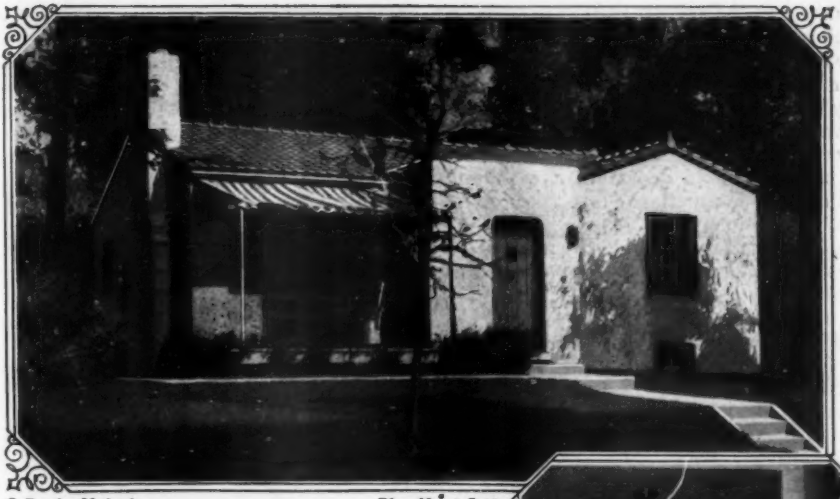
Yellow-brass castings may be given a bronze surface in the following manner: Mix equal parts of sulphuric acid, nitric acid and water, first pouring the nitric acid into the water, then slowly adding the sulphuric acid. The brass castings are first dipped in boiling water, then into the acid solution and quickly into the boiling water again, after which they are thoroughly rinsed in clean water. Then, they are dried in sawdust. The castings must be clean and free from soldering fluxes. The surface should be given a coat of lacquer.

Nailing Bridging to Joists

On one of my first jobs, I was put to nailing bridging, the boss showing me exactly how the work was to be done. He had me start the nails as customary and then carry the bridging up onto the joists to be nailed into place. I started in and nailed one piece, then turned and nailed another, turned again and nailed a third, and also turned to nail the fourth. Turning each time got rather tiresome so I determined that on the next section of bridging, this trouble would be eliminated. Accordingly, I laid the bridging in pairs on a near-by beam in the manner shown in the illustration. I nailed pieces 1, 2, 3, etc., in place, and after I had a single line of bridging in, I proceeded with those to be nailed on the opposite sides of the joists. This method made it necessary to turn only once. I had, of course, marked the joists so that the bridging would be straight.—H. H. Siegele, Emporia, Kans.



Method of Nailing Bridging without the Necessity of Constant Turning



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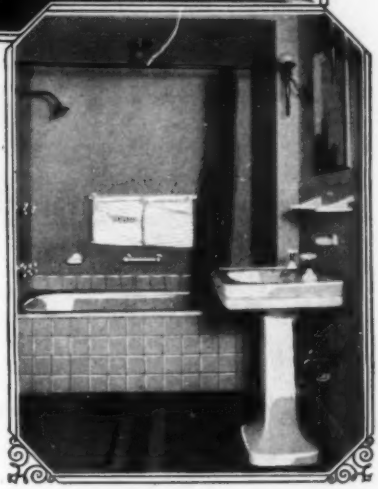
Plan No. 4-S-41



A Low Cost House Need Not Be A Cheap One

YOU often see and hear the word cheap used in referring to low-cost houses. Do not be misled into thinking that just because a small house costs as little as $4,500, it is built of shoddy materials and will crumble in the face of the first husky storm. Keep this point in mind: That a thing is low in cost doesn't necessarily make it cheap. For example, there's a certain automobile everybody knows that has no doubt cost as much to manufacture as all other cars combined, but the fact that it is sold at a rock-bottom price doesn't make it cheap. Not at all.

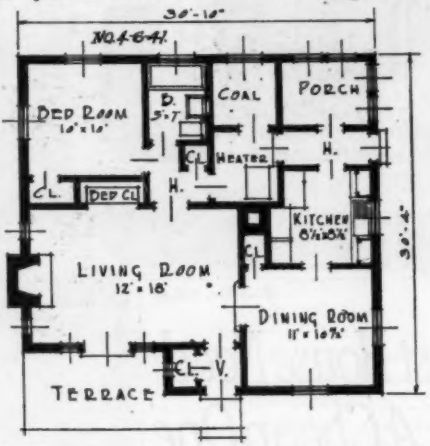
Take the little Spanish bungalow illustrated above. Under normal conditions you may be able to build it for around $4,500 or perhaps even less. You can, however, spend as much as $10,000 on it without departing one iota from the size and plan. The difference between these two costs will be represented by a luxurious equipment, finish, super-fixtures and gold-plated door knobs, so to speak. That doesn't make the $4,500 house any less serviceable, comfortable or sound structurally. As a matter of fact, unless framing, bracing, footings and other structural

HOW TO GET A BLUEPRINT

To help our readers get started on one of life's most glorious experiences—building and owning a home—Popular Mechanics Magazine will supply readers a one-sheet blueprint of any house appearing in the magazine for $1. This blueprint does away with the necessity of first purchasing a complete set of plans to find out whether you can afford to build. It contains floor plans, elevations, a section detail, size of joists, studs, etc., and also a brief specification. Submit it to tradesmen and dealers for building estimates. State whether you want masonry or frame construction.

members in the $10,000 house are of good workmanship, at the end of a year or two, the sidewalls may crack, woodwork warp, plumbing balk and a long list of other ills may appear.

And so, as we talk to you each month about low-cost houses, do not think we are asking you to depart from standard and sound construction. Just as automobiles change in style and methods of construction, so do houses. If we show you how some clever designer has used space and materials scientifically to save money and clip corners, we are trying to help you lower costs and get the most for your dollars without cheapening construction. After all, it isn't what you pay but what you get for what you pay that determines whether your house is sound in value. Beware of the word cheap. It doesn't always mean low cost.



Getting back to the Spanish bungalow, you have in this plan the latest ideas of scientific planning—the same kind that makes apartment-house efficiency so popular. But here you have it all in a small detached house. And the house can be built with or without a basement. Take your choice. Without the basement you may save fifteen per cent. If you insist upon a cellar, the stairs will descend where the heater room is now placed. This would permit you to use part of that space for a breakfast nook. In that event, you may turn the present dining room into sleeping quarters if you wish. There's a closet bed in the living room which saves from $500 to $800 for an extra bedroom.

Done in pink stucco with red roof tiles and window sash painted blue, the little place will be as sweet as you can ask for, and you may build it of either frame or masonry. The cost will range from $4,500 up, depending upon where you live and the equipment you select.

There is this to be said about costs. In areas near large cities, prices are generally higher—from fifteen to twenty-five per cent over those in smaller communities. And the chief reason is the higher wages for labor. Labor runs about fifty per cent of the job. If you are living where you can do some work yourself, there is no reason why you can't make a considerable saving. This is true on a small house of simple design and straightforward construction, like the one illustrated this month.

If your building budget is limited and you are forced to count every penny, omit the fireplace. This may net you a saving of $150 to $300. Other savings can be made. For example: You can substitute a composition-shingle roof for the tile roof shown in the illustration, but omitting both fireplace and tile roof would no doubt lessen the resale value of the house and also detract from the style.

Whatever you do, don't use inferior materials and poor workmanship. Stick to middle qualities and grades. They save you money without cheapening your house. The savings that make a house inexpensive are those of good arrangement, smaller rooms, elimination of luxuries, use of substitute materials, and not cheap and poor construction.

PLAN BOOKS FOR READERS

A NEW BUNGALOW BOOK. Just off the press. Sixteen selected low-cost bungalows in popular styles. Latest space, labor and money-saving ideas. Bungalows actually lived in. $5,000 and less. Some as low as $2,000. Book is beautifully illustrated and each house fully described. Send 10 cents in stamps to cover postage. Address Building Editor.

TWENTY POPULAR LOW-COST HOMES and Ten Commandments for Home Builders and Home Buyers. Selected houses showing variety of types, styles, materials and sizes. All planned to fit the average pocketbook. Some as low as $2,000. Send 10 cents in stamps to cover postage. Address Building Editor.